Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

SEPTEMBER ★ 1950

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

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Keep heat and heating costs from

"HITTING the CEILING"

THIS WINTER, why not see that you get *all* the heat you are paying for? Let Thermolier Unit Heaters bring both your heat—and your heating costs—down to a *reasonable* level.

HEATING COMFORT Thermolier Unit Heaters provide quick heating from a cold start. Desired temperatures are easily maintained within a close range. Heat is uniformly distributed in the working zone by forced air circulation. It is a very flexible system because different or changing heating requirements are easily satisfied by means of different models, a range of capacities, single — or two-speed motors and individual thermostatic controls.

LOW FIRST COST Thermolier Unit Heaters are so efficient and so compact that their heating capacity is often equivalent to the capacity of cast iron radiation or pipe coils of twice the cost. Additional savings are effected because the system requires a proportionately smaller amount of pipe, fittings and accessories.

ECONOMY OF OPERATION Heat is forced down to the working level . . . not banked uselessly at the ceiling level. Heat is turned on and off merely by throwing a switch either manually or automatically by simple thermostatic controls. The rapid response means that heat is furnished only when and where it is wanted . . . no heat is wasted.

ADAPTABILITY TO EQUIPMENT AND FLOOR LAYOUT Thermolier Unit Heaters are widely used in industrial plants and warehouses, garages, stores and public buildings. The units and the simple piping are overhead where they do not interfere with arrangement of operating machinery or equipment and do not take up valuable floor or wall space. Units are easily relocated at any time to meet changes in layout.

THERMOLIER UNIT HEATERS HAVE IMPORTANT CONSTRUCTION ADVANTAGES The design of Thermolier Unit Heaters is the product of Grinnell Company's 100 years of heating experience. Heating experts like Thermolier's dependable operation, freedom from maintenance troubles and durability. Typical of its construction features is the patented internal cooling leg which permits the use of a plain thermostatic trap, the simplest, least expensive kind of a trap. Other features are built-in drainage, continuous rated capacity and provisions for expansion of U-tubes.

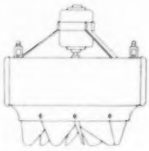
Get in touch with Grinnell or your local Thermolier distributor.

There is a type and capacity of Grinnell Thermolier for maximum heating results under every condition.

textile model

horizontal delivery

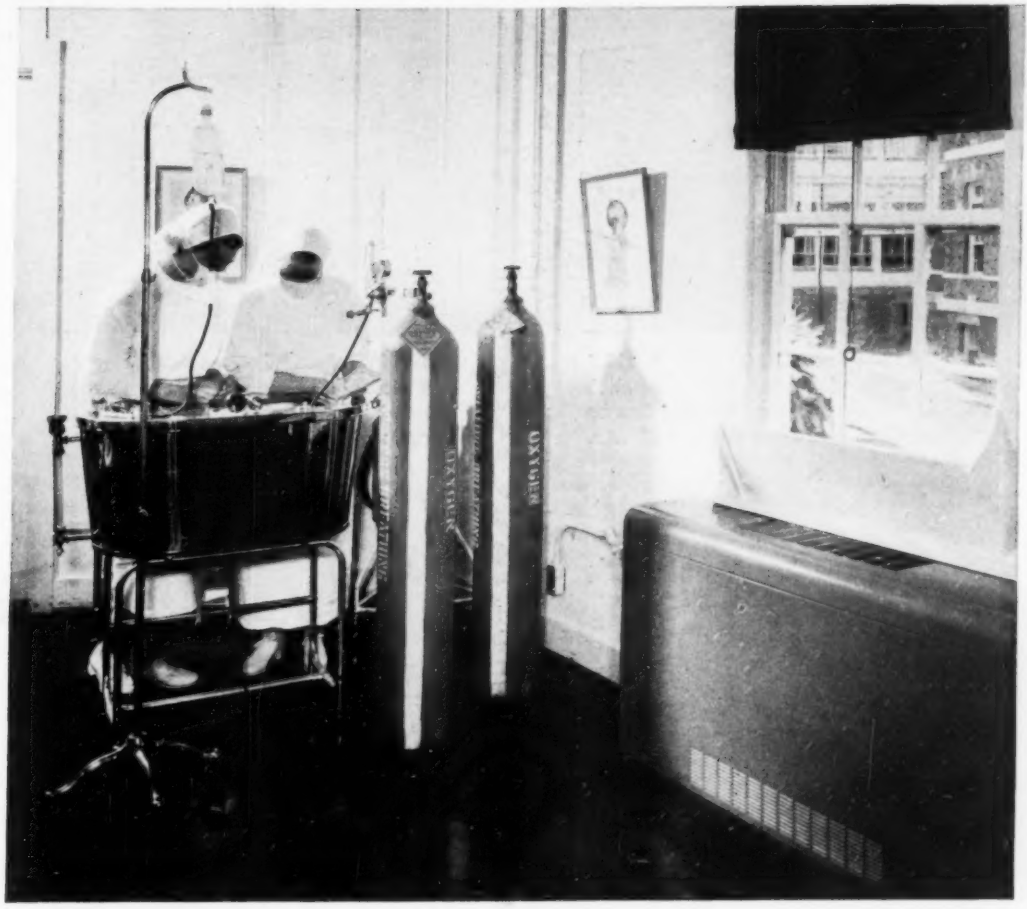
velocity nozzle


vertical delivery

GRINNELL

THERMOLIER UNIT HEATERS

Grinnell Company, Inc., Providence, R. I. Branches: Atlanta • Billings • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane



Ether proof . . . X-ray proof . . . fool-proof

Imagine what one spark might do, if it met a cloud of ether, here in the hospital. That will tell you why the handsome air conditioner you see under the window is remarkable not only for its basic design, but also for its special modifications.

For the fine new Bremerton Naval Hospital near Seattle, USAIRCO's Modu-aire was precisely "what the doctor ordered." And USAIRCO engineers, who have wide-ranging knowledge of related sciences, provided all the "specials" that were indicated. For operating rooms, explosion-proof motors. For the X-ray room, a quarter-inch jacket of lead surrounding the entire electrical system. Elsewhere, other special equipment was supplied as needed.

Modu-aire is one ultra-modern system in a family of USAIRCO products that includes just about everything known to air conditioning. It's a series of individual room units connected to a central system by copper piping. No ducts whatever . . . no intermixed "used" air . . . and no need for complicated zoning. You make your own weather, to suit yourself right in your room.

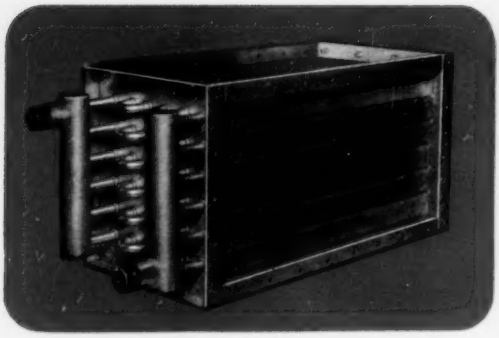
You never know, of course, what your next air conditioning job is going to be . . . or how difficult or unusual it may be. But you can be sure that if anybody has ever done it before, USAIRCO probably has. For this company was one of the early pioneers in the business, and we've never stopped learning during our quarter century of solid growth.

Our most valuable products are experience, knowledge, and ideas. Use them as you need them. They're *free*.

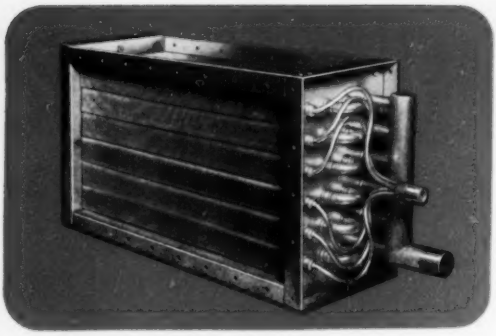
Why not wire or write United States Air Conditioning Corporation, Minneapolis 14, Minnesota.

USAIRCO

Engineers and manufacturers of air conditioning refrigeration, unit heaters, coils and ventilating equipment.

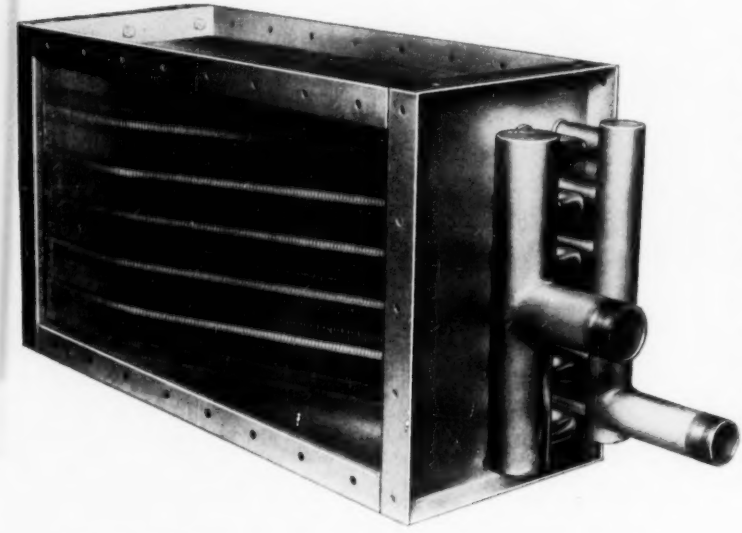


BUSH WATER COOLING COILS Supplied in standardized and matched sizes, singly or in combination. Can be arranged to fit almost any installation.



BUSH DX COILS These are constructed of aluminum fin and tinned copper tube with aluminum top and bottom plates furnished on all coils.

Outlast them all!



BUSH STEAM COILS Trouble-free service and top efficiency are yours with BUSH Standard Steam Heating Coils. They're available in five standard finned heights and variable finned lengths, with casings to match the corresponding direct expension coils. The cores are of high quality non-ferrous materials; the steel and aluminum casings are protected with zinc or lead coatings, plus a priming coat for extra protection. And they're carefully tested and accurately rated.

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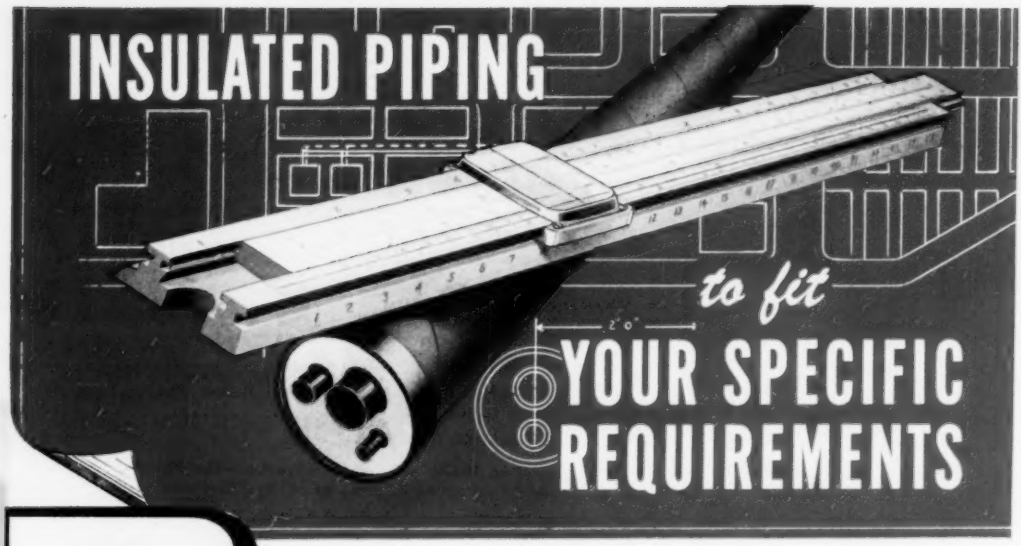
INSULATED PIPING



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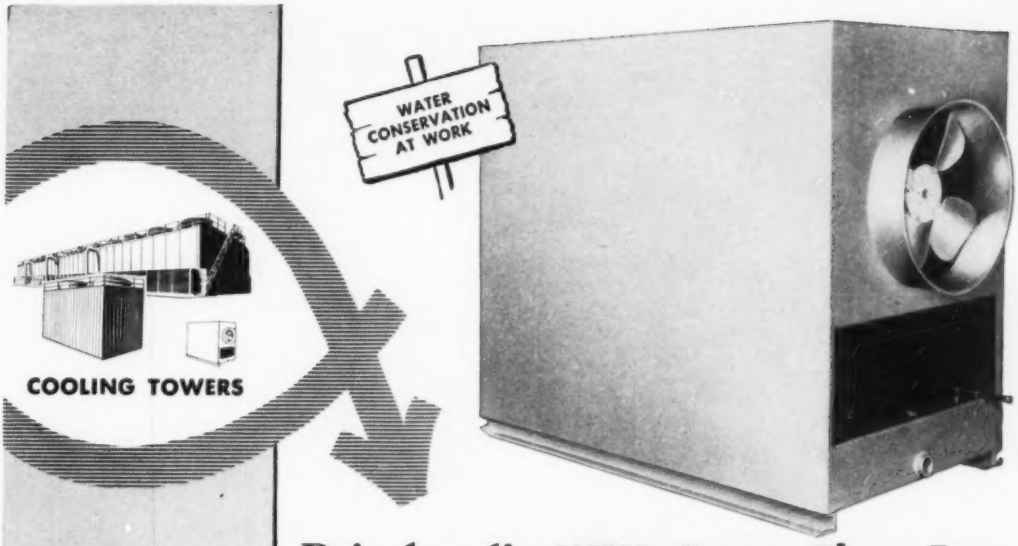

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You can now put water conservation to work efficiently and economically on air conditioning and refrigeration installations with Pritchard's new Series "P" Packaged Cooling Towers. This *low cost* Induced Draft Tower is built to give up to 20 tons capacity.

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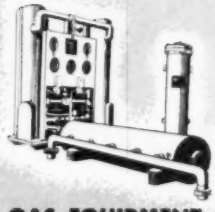

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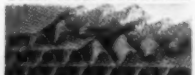

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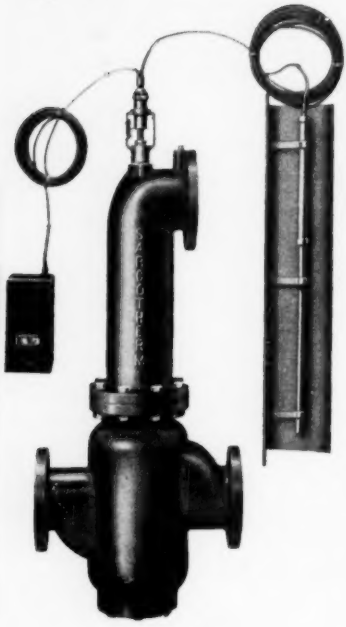

Sarcotherm engineers are constantly searching for a better product.

While utmost simplicity is still the dominant design principle, the new models now available show many important improvements and refinements.

Double Seated Valves are now used in the larger sizes, greatly increasing valve capacity and permitting smaller valves being used on a given size job. *Convenient manual adjustment* features are now provided in a variety of combinations. *Program control systems* are available to meet any specification.

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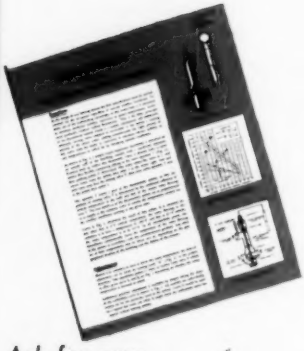

Ask for new Bulletin ST-501 describing latest improvements.

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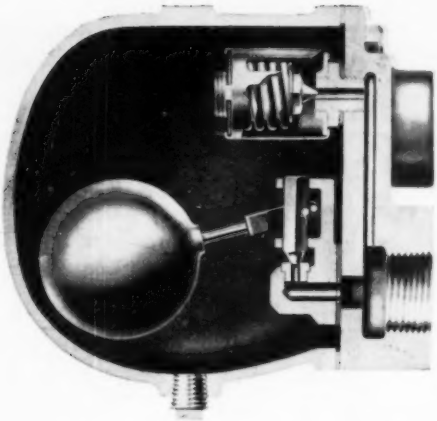

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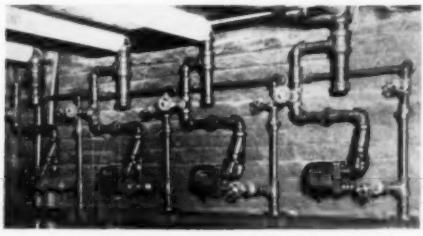
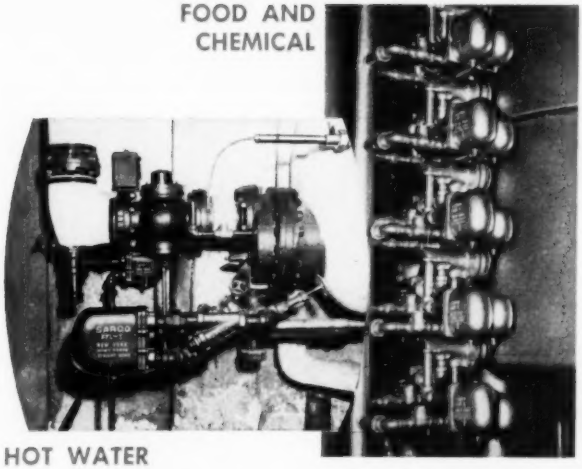


HEATING MAINS

FOOD AND CHEMICAL



HOT WATER

Here is the trap that is used by the thousands for heating coils, mains and continuous process operations. The built-in automatic thermostatic by-pass takes care of all air and gases without steam waste.

The top illustration shows a bank of Sarco FT traps dripping the ends of mains in a large office building. At the left is shown a typical installation. In the soap and food industries, in two Chicago plants, a few Sarco FT's made a million dollars worth of equipment operative where three other types of traps had failed.

The controlled hot water hook-up at the lower left is another example. The ball float in the FT trap allows continuous discharge without shock to temperature controls. Ask for Catalog No. 450.

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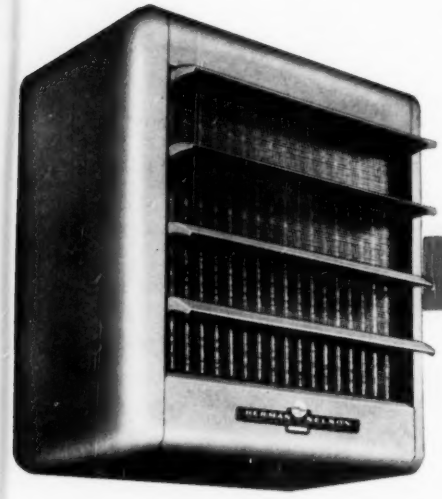
SIMPLICITY of design and operation permits a faster installation. Fewer connections, traps and valves add up to low initial cost. Unit heaters show important fuel savings—no problems of overheating—no cold spots.

EFFICIENCY by full utilization of the heat supply—steam or hot water—conservation of all floor and wall space, and ability to provide heat despite floor plan rearrangement make Herman Nelson Unit Heaters the practical modern heating method.

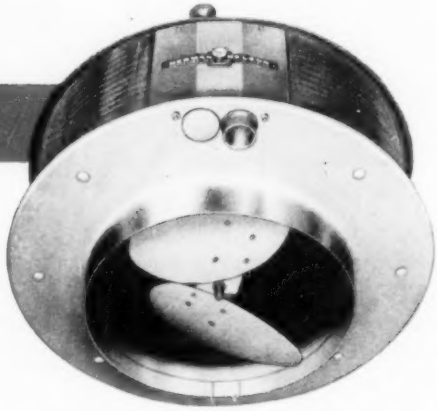


HORIZONTAL SHAFT PROPELLER-FAN TYPE UNIT HEATERS

You may choose from 18 different models—all Herman Nelson quality, rugged, stylish units. Ideal for offices, theatres, showrooms, stores and shops. Abundance of performance features include wide-faced, aerodynamic-shaped fan, patented extra heavy, red brass stay tube, specially selected motor, and loop in each tube which absorbs difference in expansion and contraction.

Quiet, trouble-free operation and topnotch efficiency. Simple automatic controls. Steel cabinet finished in platinum green.

VERTICAL SHAFT PROPELLER-FAN TYPE UNIT HEATERS



Entirely new, these circular coil units are available in thirty models. Designed for overhead suspension up to 50 feet, this efficient unit heats quickly and thoroughly in zone of occupancy. Orificed radiator tubes eliminate air binding. Tubes are expanded by hydraulic pressure into fin collars assuring permanent fit. Specially selected motor is mounted by rubber-cushioned hub ring.

Sturdily constructed steel cabinet finished in platinum green. Low, high or extra high outlet velocities. Five diffuser accessories are available. Uses steam or hot water.

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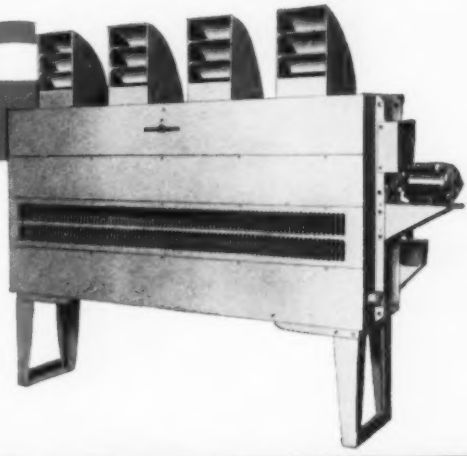

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Over eighteen hundred combinations of models, sizes and speeds available to meet the most difficult problem for industrial and commercial use, make this Herman Nelson Unit a favorite of heating engineers.

Its large heating element is of seamless, red brass. High velocity discharge with low outlet temperatures; minimum resistance to air flow. This unit has a mixing damper section—allows for mixing of indoor and outdoor air. Filter section accommodates either a cleanable or disposable filter.

Operates with steam or hot water system.

DE LUXE UNIT HEATERS

This unit is a smartly designed beauty of practical utility . . . can be installed on floor, wall or ceiling, six models available. Adjustable to direct air upward, down or at a horizontal level. Ideal for every kind of building because its attractive sahara tan cabinet lends a smart style note to any interior. Patented, extra heavy, red brass, stay tube maintains proper relationship between headers, allows entrained moisture to drain directly from supply to return header.

Takes steam or hot water supply. Extra wide flanged fin holes for efficient contact between expanded tubes and fins.

Single or two-speed motor. Aluminum fan wheels, slow tip speeds make constant heat flow, noiselessly. This unit is the standard of comparison for the industry—there's none finer on the market.

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HERMAN NELSON DIVISION

AMERICAN AIR FILTER COMPANY, INC.

MOLINE, ILLINOIS

HERMAN NELSON DIVISION
American Air Filter Company, Inc.
Dept. HP-9 • Moline, Illinois

Please check:

- ☐ Propeller Fan Type Unit Heater Catalog
- ☐ Centrifugal Fan Type Unit Heater Catalog
- ☐ Deluxe Unit Heater Catalog

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Company_____

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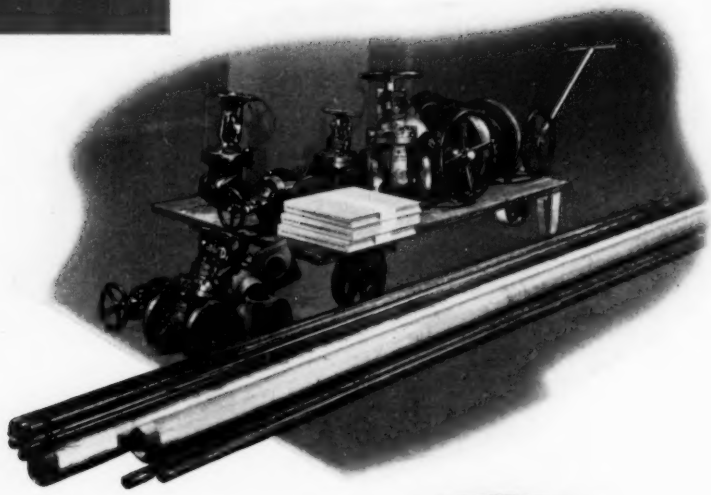
YOUR SPANG CW DISTRIBUTOR HAS

the things you want



Your Spang CW Pipe Distributor has the things you want! A complete line of piping materials — a real desire to render fast, complete service.

One of the many complete lines he carries is Spang CW Pipe in black and galvanized finishes, all standard sizes, and convenient uniform lengths. Threads, dimensions, inside and outside surfaces are subjected to rigid inspection, and each length is hydrostatically tested to assure a strong, tight longitudinal weld from end to end.

Next time you need steel pipe, fittings, fixtures, valves or other piping material, call your Spang Distributor. He has everything you want.

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Division of The National Supply Company
EXECUTIVE OFFICES: PITTSBURGH, PA.
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SPANG CW

QUALITY *that is recognized wherever pipe is used*

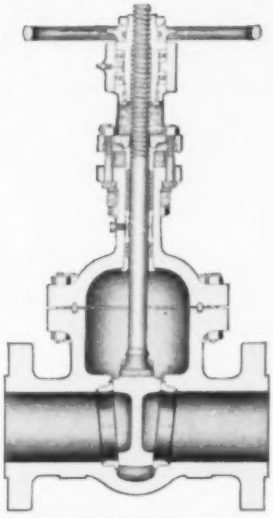
For the best in power piping...
Look to the complete CRANE line

STEEL VALVES FOR GENERAL STEAM SERVICES

You can count on Crane Cast Steel Wedge Gate Valves for dependable performance under the most severe service conditions. Straight-through ports minimize turbulence, erosion and resistance to flow. Long, close-fitting disc guides assure tight seating.

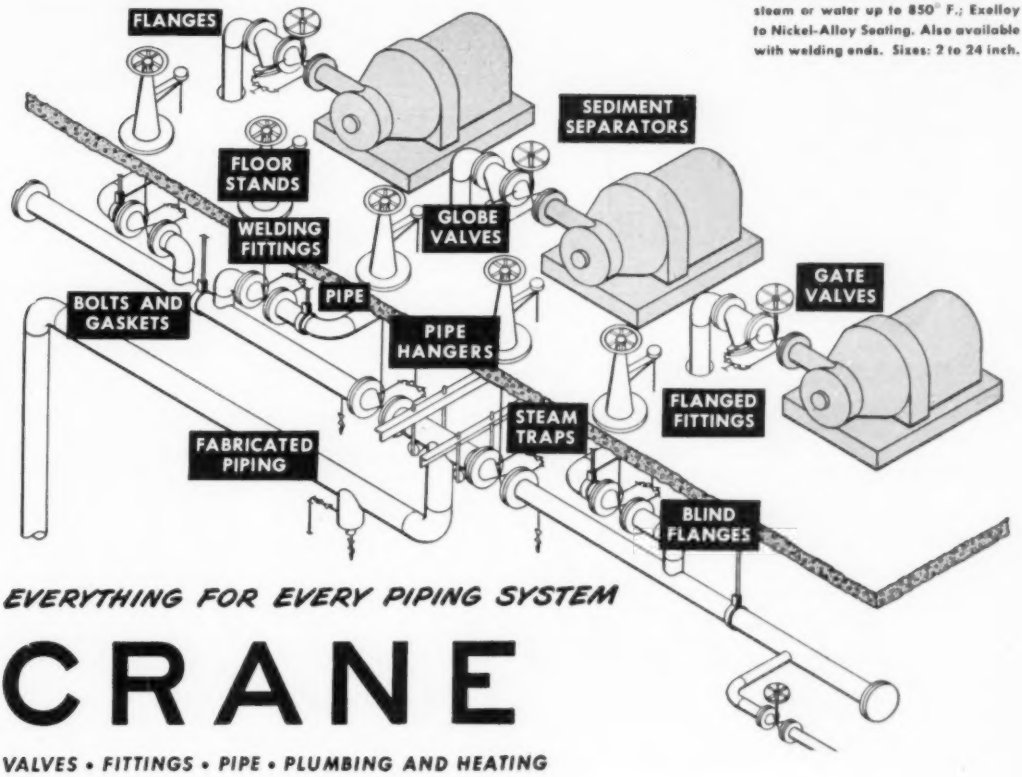
Strong tee-head disc-stem connection, easily lubricated yoke bushing, and ample bearings provide smooth operation. Made of Carbon or Alloy Steel suitably trimmed for pressures and temperatures up to 2500 pounds at 1000° F. Available with flanged, screwed, or welding ends. See your new No. 49 Crane Catalog.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



No. 76XR, 600-Pound Steel Gate. For steam or water up to 850° F.; Exalloy to Nickel-Alloy Seating. Also available with welding ends. Sizes: 2 to 24 inch.

THIS STEAM TURBINE PIPING INSTALLATION CAN BE 100% CRANE ON ONE PURCHASE ORDER



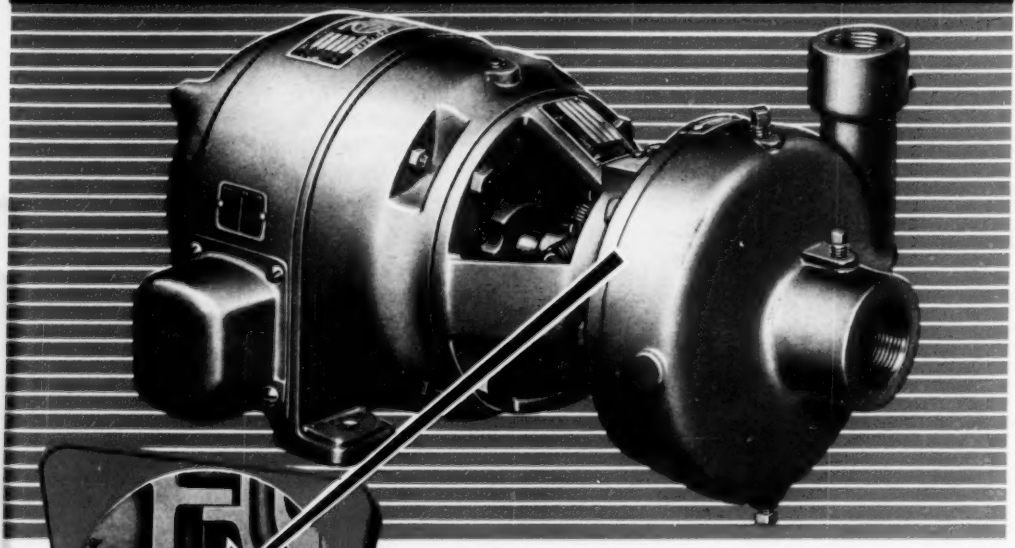
EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

THE 1522 *Challenges Comparison*

. . . WHERE ELSE CAN YOU FIND SO MANY MONEY-SAVING FEATURES IN ONE PUMP!



B & G REFRIGERATION EVAPORATOR

B & G Evaporators, Condensers, Liquid Receivers and Heat Exchangers protect your reputation and profits by giving long, trouble-free service. Send for engineering data.

NO. 1—LEAK-PROOF MECHANICAL SEAL

This feature alone establishes the B & G 1522 Pump as the "buy" for your cooling tower or evaporative condenser installations. A Mechanical Seal, instead of an ordinary stuffing box, assures long, trouble-free service. The Seal is self-lubricating and eliminates the usual leakage through the packing gland. B & G 1522 Pumps are giving leak-proof service the country over!

It's a *quiet* pump! Long bronze sleeve bearings keep the shaft in alignment and spring-type flexible couplings aid in keeping noise at a minimum. The impeller is *hydraulically balanced* . . . highly efficient throughout the capacity range.

You can really *get into* the B & G 1522—if ever necessary. Remove a few bolts and the pump separates into three parts—motor, bearing bracket sub-assembly and pump body. Manufactured to close tolerances, the bearing bracket sub-assembly, including shaft and sleeve bearings, is interchangeable in all B & G 1522 Pumps.

Next time you have a pump to buy, look first at the B & G 1522. It is available as all-iron, bronze-fitted or all-bronze. Send for Catalog CY-350.

Hydro-Flo* REFRIGERATION EQUIPMENT

BELL & GOSSETT COMPANY

Dept. RBS-5, Morton Grove, Illinois

*Reg. U. S. Pat. Off.

WeldELLS®

Whatever you seek on that next welded piping job...*speed*...*economy*...piping for *extreme conditions*...piping to withstand *corrosion*...you will find the answer to it in piping welded the WeldELL way.

You will find the answer because the WeldELL line incorporates job-speeding, cost-cutting features that are combined in no other welding fitting.

You will find the answer because the WeldELL line expresses the best of all we have learned in fifty years of intensive specialization in forged fittings for designed piping and pressure vessels.

The WeldELL line also goes beyond all others in range of sizes, types, thicknesses and scope of materials. Form a good habit—the WeldELL habit. Your reward will be the deep-down satisfaction of using the best there is! Coupon brings catalog.

Taylor Spiral Pipe is again promptly available in a broad range of sizes and thicknesses. Coupon brings new Spiral Pipe Bulletin 493.

TF

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, P.O. Box 485, Chicago 90, Ill.

Offices in all principal cities.

Eastern Plant: Carnegie, Pa. • *Western Plant:* Fontana, Calif.

☐ Please send new Catalog 484 covering welding fittings and forged steel flanges.

☐ Send new Bulletin 493 covering Taylor Spiral Pipe and related fittings.

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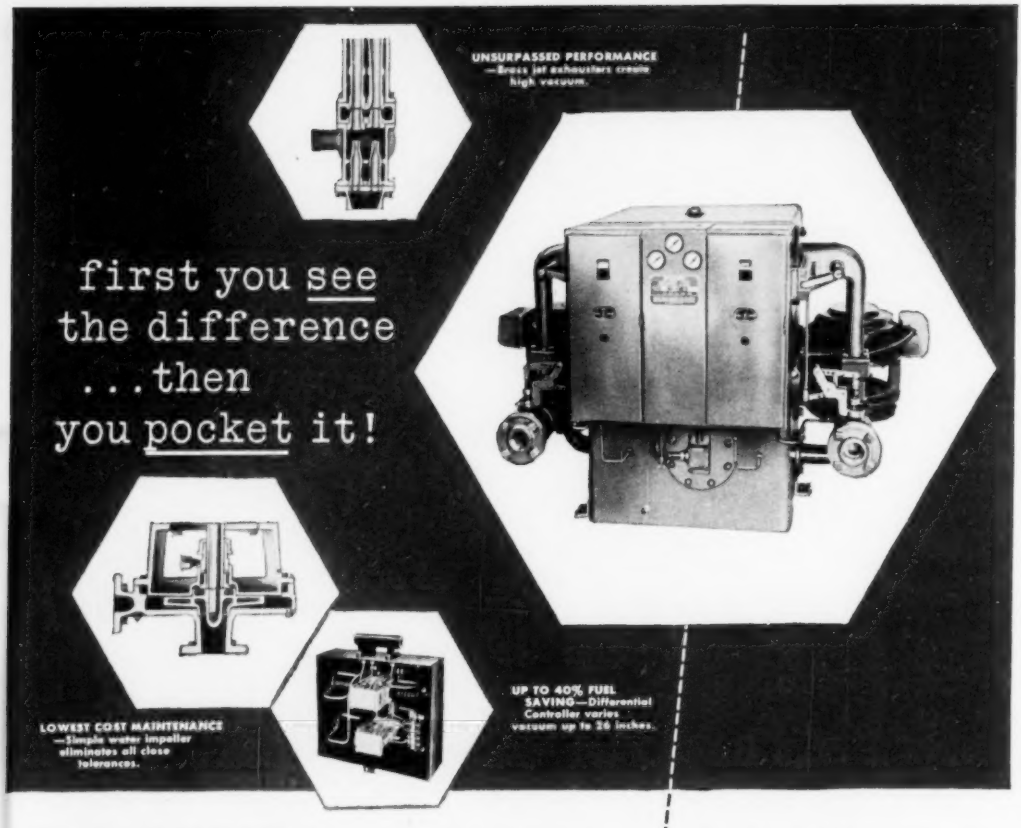
510-0920 Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.


UNSURPASSED PERFORMANCE
—Brass jet exhausters create high vacuum.
first you see the difference ...then you pocket it!
LOWEST COST MAINTENANCE
—Simple water impeller eliminates all close tolerances.
UP TO 40% FUEL SAVING—Differential Controller varies vacuum up to 26 inches.

DUNHAM VACUUM PUMPS step up steam circulation... lower fuel costs. Your customers get more heat for their money when you install a Dunham Vacuum Pump. *Designed to pull up to 26 inches of vacuum,* these pumps easily handle the requirements of any steam heating system. Provide better circulation and control of steam . . . shorten "heating up" periods.

Dunham Vacuum Pumps are extremely simple and compact in design. The only principal moving element is the water impeller. Flow of water through the exhauster jets creates high vacuum . . . maintains positive pressure to discharge condensate direct to boiler. There are no moving parts under vacuum . . . no close tolerance parts to slip out of adjustment.

Available as single or duplex units—in a full range of capacities to meet most heating demands. Dunham Vacuum Pumps are ready for immediate operation on delivery.

These Pumps Help Dunham Differential Heating Cut Fuel Costs up to 40%
These pumps are the heart of the famous Dunham Vari-Vac* Heating System . . . the precision temperature control system that, for example, has enabled the Millard Fillmore Hospital, Buffalo, N. Y., to save 37.8% annually on steam consumed since 1935.

SEND FOR THIS FREE BULLETIN!

Write today for your free copy of File No. 4C-2-8, giving complete facts and figures about these cost-saving Vacuum Pumps and other Dunham Heating Products. C. A. Dunham Co., 400 W. Madison St., Chicago 6, Ill. *In Canada:* C. A. Dunham Co., Ltd., Toronto. *In England:* C. A. Dunham Co. Ltd., London. *Sales Engineers and Jobbers in All Principal Cities.*

**Variable Vacuum*

FROM A SINGLE TRAP . . . TO A COMPLETELY ENGINEERED SYSTEM . . .

DUNHAM **HEATING MEANS BETTER HEATING**

ARMSTRONG TRAPS KEEP HEATING SYSTEMS

hot and healthy!

1. Save Fuel
2. Reduce Maintenance
3. Provide Fast Heat-Up
4. Insure Continuous Service
5. Help Avoid Corrosion

NO MAINTENANCE IN 6 YEARS on 350 Armstrong traps draining 15 lb. heating system, including unit heaters, coils, radiators, steam mains and headers. *Plymouth Shoe Company, Middleboro, Massachusetts*

10-15% REDUCTION IN HEAT-UP TIME, trap maintenance costs reduced 50%, since installing Armstrongs to drain the 5 psi heating system to a 10" vacuum return at *John Deere Ottumwa Works, Ottumwa, Iowa.*

SAVES 20% ON FUEL, since installing Armstrong Blast Traps with thermic air vents to drain heating coils at *Norton Greenhouses, St. Paul, Minnesota.*

***THESE TWO USEFUL HANDBOOKS** for engineers, contractors and pipe fitters tell how and why Armstrong Steam Traps will rejuvenate your heating system:

1. **HOW TO SELECT STEAM TRAPS FOR UNIT HEATERS** by the BTU Method and Condensate Weight Method; tables of BTU outputs of heaters produced by 24 manufacturers; installation methods, tables and charts.

2. **THE ARMSTRONG STEAM TRAP BOOK** — 36 pages of data on design, construction, selection, installation and maintenance of Armstrong Steam Traps for all services, all pressures.

ARMSTRONG STEAM TRAP

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Please send me: ☐ "How to Select Steam Traps For Unit Heaters"
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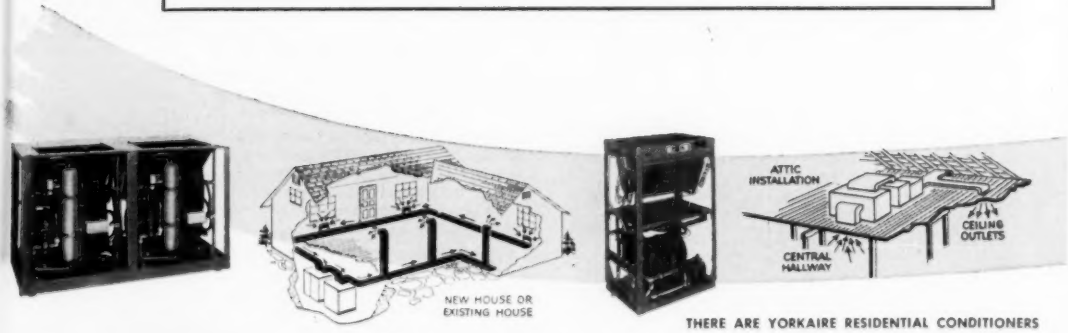
CITY_____ POSTAL ZONE_____ STATE_____

THE NEWEST in Air

ANNOUNCING—the sensational Yorkaire completely Hermetically Sealed Circuit Conditioner that makes possible air conditioning for the entire home that is as Trouble-Free and Simple as the modern home refrigerator, *and at a cost most everybody can afford!*



THERE ARE YORKAIRE RESIDENTIAL CONDITIONERS

York
refrigeration
air-conditioning

Another big *Headquarters for*— Refrigeration

FOR YOUR NEAREST YORK REPRESENTATIVE

Conditioning for the Home

Here it is! The big air conditioning news of the year! Luxurious, comfortable, mechanically cooled and dehumidified air for the entire residence with the same dependability, the same freedom from trouble your clients have learned to demand from the most modern home refrigerator.

And here's what made it possible:

The Yorkaire Sealed Circuit Conditioner has a trouble-free, completely hermetically sealed cooling system—tested and heat-sealed at the factory. Dirt can't work its way in. The refrigerant can't leak out.

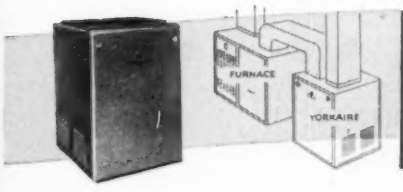
It is the most positive assurance of dependable residential air conditioning ever offered home owners! Assures simplicity of installation! Assures simplicity of operation! Assures the lowest possible costs: less than $1,000 to cool an average size 5 room home heated by forced warm air!

The "hermetic seal" principle of the Yorkaire Residential Conditioner cooling circuit has proved itself season after season to thousands of enthusiastic users of York's famous single-room air conditioners and multiroom and commercial size "package" units. And it has proved itself as well in York's Automatic Ice Maker, developed to provide the food and beverage industry with a convenient, economical, point-of-use source of pure, clear, uniformly crushed ice and the famous "ice cube with the hole."

You'll be amazed at the speed and ease with which Yorkaire Sealed Circuit Conditioners can be installed—using the ducts of present heating plants or, at additional cost, as an independent central system, or series of remote units—tucked away wherever there's waste space.

And whatever the type or size of the home—dream stage or existing construction—there are Yorkaire Sealed Circuit Conditioners, sizes and models, to dovetail perfectly with your cooling and dehumidifying specifications.

By all means, call your York Representative now to arrange for your future installations. York Corporation, York, Penna.



Your York Representative is an air conditioning specialist, able and qualified to provide maximum efficiency and tight-fisted economy whether you're interested in room, residential, office, store or commercial air conditioning.

FOR ALL TYPES OF HOUSES—ALL APPLICATIONS

advance from YORK and Air Conditioning

SEE YOUR CLASSIFIED TELEPHONE DIRECTORY

BUILD PROFITABLE SALES with *Complete* NATIONAL Heating Systems

to solve every Modern Heating Problem

Three National Commercial Steel Boilers were installed in the Dupont Plaza Hotel, Washington, D.C., shown above. These oil-fired boilers provide 25,022 square feet of radiation and supply domestic hot water through an indirect water heater for 329 apartments and the first floor Lobby, Dining Room and Cocktail Lounge. Alvin L. Aubinoe, Inc., Builder; Aubinoe, Edwards & Berry, Architects; Standard Engineering Co., Heating Contractor.

Whether it's the heating of a small home or apartment unit, an average size residence or the largest multi-family apartment or commercial building—there's an efficient National hot water or steam heating system available, complete from Boiler to the most advanced types of Baseboards, Convectors or Radiators. National Research Engineers have designed effective, simple-to-operate and economical Heating Units for every type of fuel and condition.

This distinguished family of National Heating Products—all of which find ready customer acceptance—gives the Heating Wholesaler and Contractor the opportunity to meet heating needs most satisfactorily . . . which means fast, easy sales with substantial profits.

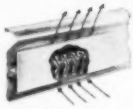
Get in touch with your nearest National representative for further information and a discussion of the heating requirements of your current building program.

The new, all-in-one automatic National Packet Heating Unit for small homes, motels, diners and stores.

Cast iron National Heat Extractor boilers in sizes ranging in Net I-B-R Ratings from 170 to 10,300 sq. ft. of steam and from 270 to 16,480 sq. ft. of water.

National Steel Boilers in sizes ranging in SBI Net Ratings from 275 to 35,000 sq. ft. of steam and from 400 to 56,000 sq. ft. of water.

National Gas Boilers ranging in net ratings from 105 to 9,690 sq. ft. of steam and from 195 to 15,505 sq. ft. of water. A.G.A. approved for use with all gases.



National Art Baseboard

National Art Radiators

National Art & Aero Convectors

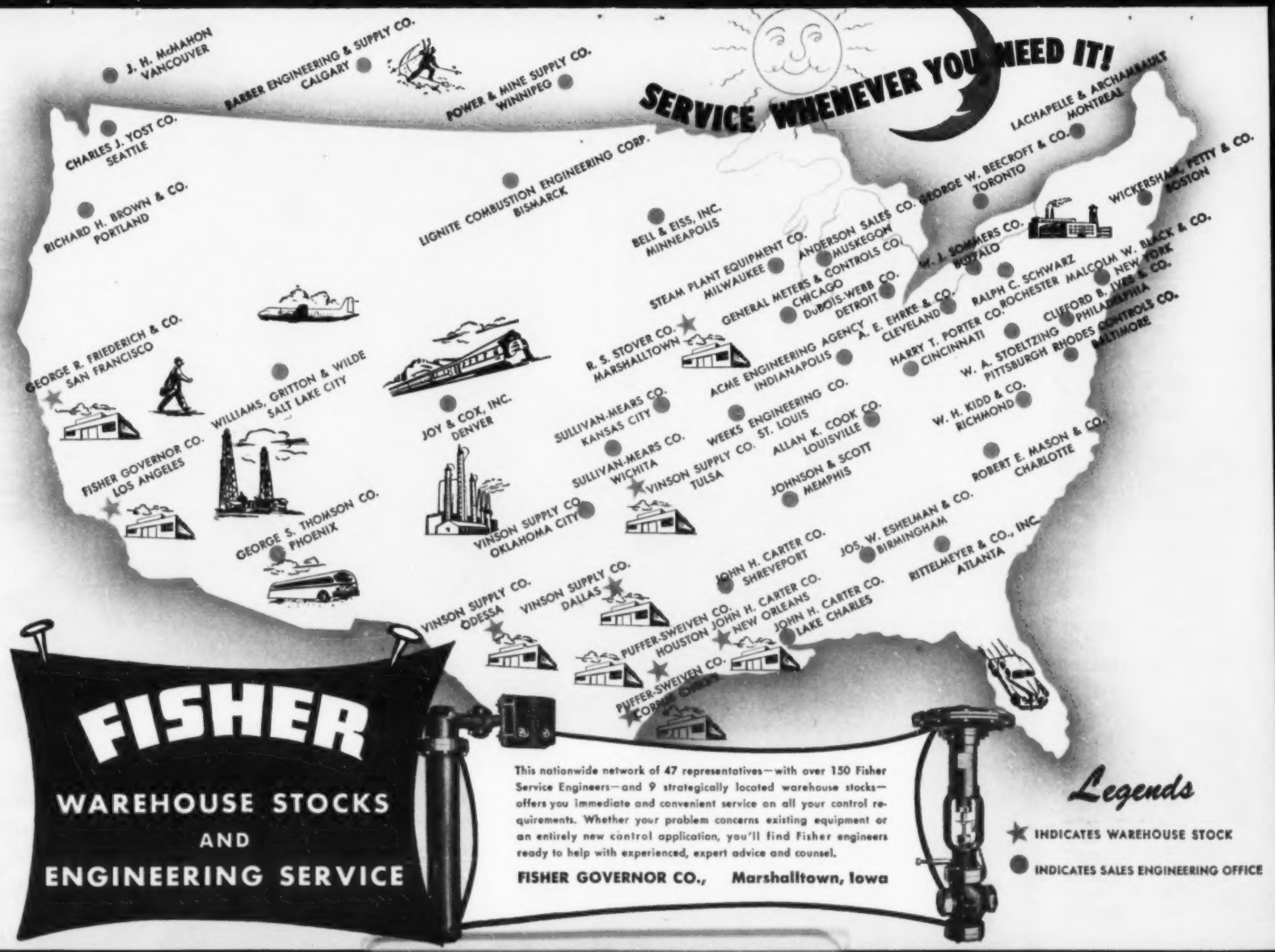
National Unit Heaters

HEATING ACCESSORIES
Valves
Fittings
Controls, etc.

NRC

THE NATIONAL RADIATOR COMPANY

JOHNSTOWN, PENNSYLVANIA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This nationwide network of 47 representatives—with over 150 Fisher Service Engineers—and 9 strategically located warehouse stocks—offers you immediate and convenient service on all your control requirements. Whether your problem concerns existing equipment or an entirely new control application, you'll find Fisher engineers ready to help with experienced, expert advice and counsel.
FISHER GOVERNOR CO., Marshalltown, Iowa
Legends
INDICATES WAREHOUSE STOCK
INDICATES SALES ENGINEERING OFFICE

HOTTER, SOONER steam traps.. knock cold spots out of platens

Cold spots in press platens at this large western plywood plant are a thing of the past since they've installed the steam traps that get equipment *hotter, sooner*—Yarways.

Yarway Impulse Steam Traps never allow condensate to accumulate and pull down working temperatures. They discharge the condensate *as fast as it forms.* Result—equipment always operates at highest efficiency.

Couple this fact with other features like small size, easy installation, only one moving part, non-freezing, good for all pressures, low cost—and you know why more than 650,000 Yarway traps have already been installed.

Try a Yarway *for free* in your own plant. Your nearest distributor will supply it. For name, or free bulletin write to . . .

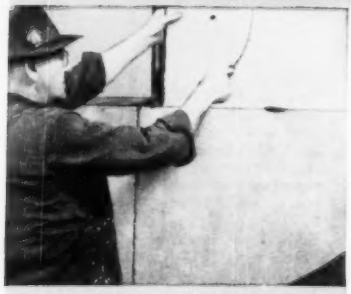
YARNALL-WARING COMPANY
107 Mermaid Ave., Philadelphia 18, Pa.

Stainless Steel Body

YARWAY IMPULSE STEAM TRAP

This is the Kind of Idea That Wins a Hundred Bucks

"I apply Aerocor with pitch, then secure it with glass tape, and spray paint it."



"I cut Fiberglas Coated Duct on the job with a jackknife."

"I line with Coated Duct the Stik-Clip way, and often cover with Aerocor."

ACT NOW! YOU CAN STILL WIN!

WIN $100!

No Limit to the Number of Winners!

Just answer the question:

WHAT'LL THEY DO NEXT WITH

OWENS-CORNING

FIBERGLAS

?

Aerocor* and Coated Duct Insulations

Probably you've already earned your hundred bucks—all you have to do now is tell us about it! Surely, someplace in your work you have made an interesting, new, unusual application of Fiberglas insulation. Well, say so—and the money is yours!

These surprising materials have revolutionized insulating practice. They're so adaptable that new applications and application methods come up daily. So—we want to pass the word along nationally. That's the reason for this easy contest. Send in your entry, get the easiest hundred bucks you ever earned!

Rules of the Contest

Write us a letter describing a **NEW OR UNUSUAL APPLICATION OR APPLICATION METHOD** of Fiberglas* Aerocor or Coated Duct Insulation. A letter stands to win $50 **OR $100 IF ACCOMPANIED BY A SNAPSHOT OF THE JOB.** Literary style or quality of photo are not considered in judging. **EACH ACCEPTED ENTRY** receives $50, **OR $100 IF ACCOMPANIED BY A SNAPSHOT.** Judges' decisions are final. Judges are: A recognized Heating and Ventilating Engineer, an Editor of this magazine, an Owens-Corning Fiberglas Corporation Technical Man. All entries become the property of this company. To qualify, an entry must be at the Owens-Corning Fiberglas Corporation office not later than **MIDNIGHT, OCTOBER 30, 1950.**

Want an extra hundred dollars? Chances are you already have a likely application! **LET'S GO!**

OWENS-CORNING FIBERGLAS CORPORATION
Dept. 40-I, Toledo 1, Ohio

Fiberglas is in your life . . . for GOOD!

*Fiberglas is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corp. for a variety of products made of or with fibers of glass. Aerocor is a trade-mark of Owens-Corning Fiberglas Corp.

These are typical, everyday uses

Fiberglas Coated Duct Insulation inside and outside a duct. It resists erosion up to 5,000 FPM.

Fiberglas Aerocor on an irregular, heated surface. Weight for weight this insulation has the lowest heat conductivity known.

Fiberglas Aerocor applies quickly with glass tape, wire, or an undercoat of pitch or bitumen.

WORTHINGTON AIR CONDITIONING REPORT

WORTHINGTON PUMP AND MACHINERY CORPORATION
HARRISON, NEW JERSEY

Specialists in air conditioning and refrigeration for more than 50 years

We're Part of the HOSPITALITY at the Westward Ho

If ever the name of a hotel suggested an invigorating atmosphere, it's the spectacular Westward Ho in Phoenix.

Internationally famous as a resort hotel, the Westward Ho gives its guests the year-'round comfort of air conditioning, furnished by Worthington equipment.

Five years ago, when the hotel wished to expand its air conditioning, a Worthington centrifugal compressor was installed, with the original unit put aside for stand-by service.

Last year, an annex to the hotel was built, and Worthington equipment was again selected: two Freon reciprocating compressors and one condenser.

Distributor: Frank Harmonson Co., Phoenix.

Westward Ho is Phoenix' largest hotel. It is completely Worthington-conditioned.

La Mina Room, one of the several dining rooms in the Westward Ho.

Cool, comfortable air, Worthington-supplied, adds to the charm of this typical suite in the Westward Ho annex.

Two Worthington Freon-12 6HF4 Compressors installed in the new annex.

Now They Trade in Comfort on the New Orleans Exchange

New Orleans Cotton Exchange —completely air-conditioned by Worthington.

Consulting Engineers—Leo S. Weil and Walter B. Moses.

Contractor—Mayer Godchaux

During its nearly 80 years, The New Orleans Cotton Exchange has undoubtedly observed many scenes of feverish trading, but since 1948 the air, at least, has maintained a moderate temperature.

Worthington centrifugal refrigeration makes the difference. The Worthington system has a capacity to cool 420 gpm of water from 55.6 F to 46 F when supplied with 545 gpm of condensed water at a maximum of 87 F. Capacity rating for the entire system is 160 tons.

Worthington Makes a Hit in Sangamo's Auditorium

Auditorium in plant of Sangamo Electric Co., a leading manufacturer of electric measuring and control equipment, Springfield, Illinois.

The modern auditorium built by Sangamo Electric Corporation to be used as a meeting place for employee training courses, sales conferences, and employee organizations, provides the year-'round comfort of Worthington air conditioning.

The equipment, installed by Henson Robinson Co. of Springfield, Ill., includes a 3HF6 Freon-12 compressor, an AVY air conditioning unit, and an ECZ evaporative condenser. The system is rated at 15 tons and handles 4500 cfm. 95% of the condenser water is saved for re-use.

Here's how the system operates. A single off-on wall switch controls the entire system, with inter-locks for proper sequence of operation. A room-type cooling thermostat actuates a solenoid valve in the Freon liquid line. A heating thermostat actuates a modulating-type steam valve and modulating-type motor connected to air conditioning face and by-pass damper.

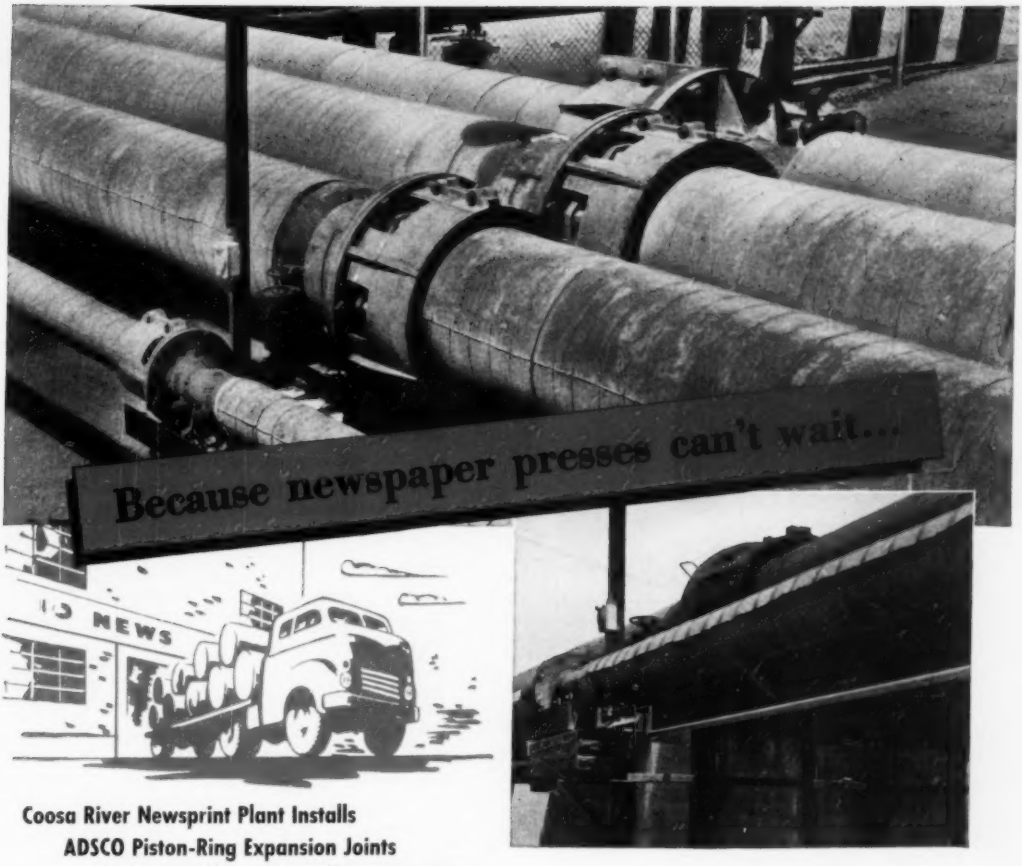
A manual modulating-type control and motor secure the desired mixture of fresh and recirculated air entering the unit (maximum 3000 cfm). Automatic change-over from heating to cooling cycle, or vice versa, is provided.

In order to prevent freezing of water in the evaporative condenser, located in the equipment room, a duct arrangement with temperature controller and damper motor was installed. This insures trouble-free operation when outside temperature falls below 35 F, since the evaporative condenser supply air is taken from the equipment room.

WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

A complete line . . . in which *all* the vital components are *made*, not just assembled by Worthington. For more worth with Worthington, see your nearby Worthington distributor (consult Classified Telephone Directory).



Coosa River Newsprint Plant Installs ADSCO Piston-Ring Expansion Joints To Prevent "Down Time" in Steam Lines

● Newspaper presses can't wait for paper. Nor can a paper mill allow maintenance problems to slow down the continuous flow of newsprint to the presses. That's why the new $32,000,000 Coosa River Newsprint plant at Childersburg, Ala., uses ADSCO Piston-Ring Expansion Joints. They can be packed under full line pressure... no "down time"... no loss of production.

These ADSCO Joints are engineered to meet the most demanding conditions, in steam lines carrying pressures up to 600 lbs. and temperatures up to 750 F. This completely modern, 430-ton-per-day southern mill uses 47 ADSCO Expansion Joints, chosen for dependability and low-cost maintenance.

ADSCO's exclusive piston-ring construction holds the line pressure even when the packing is completely removed. Internally and externally guided for true slip alignment, yet no metal is in contact with the polished slip surface. Limit stops prevent overtravel of slip.

ADSCO Slip Type Joints are available in a full range of sizes, in both single or double units, with 4", 8" or 12" traverse per slip, and for a wide range of pressures and temperatures. For additional information, see your nearest ADSCO representative or *write for Bulletin No. H-35-15F.*

ADSCO offers the most complete line of expansion joints available from any manufacturer. For an impartial installation recommendation, consult the company that makes all types.

ADSCO

EXPANSION JOINTS — HEAT EXCHANGERS
STEAM TRAPS — STRAINERS — METERS
CASING — ANCHORS — GUIDES

Leaders Since 1877

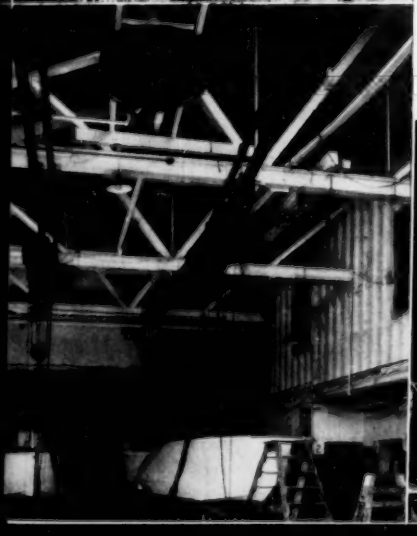
AMERICAN DISTRICT STEAM CO.
NORTH TONAWANDA, N. Y.

Why Heating Men Standardize on

Bowling Alleys

Public Recreation Rooms

Department Stores



Boat Building Plants

COMPLETE LINE—Fedders Vertical and Horizontal Unit Heaters are built in a well-graduated range of sizes and capacities for use with steam or hot water.

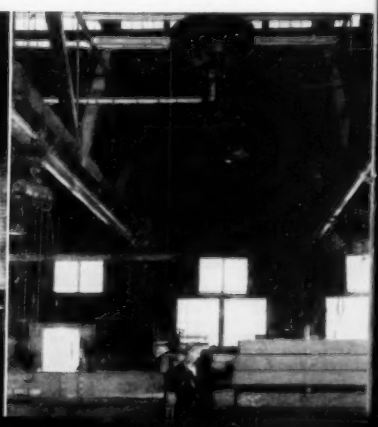
ADAPTABILITY—Their operating characteristics combine high heat transfer efficiency, directional placement of heat, quick warm-up, easy installation and quiet operation.

ADVANCED DESIGN—The advanced design of Fedders Vertical and Horizontal Unit Heaters has earned a reputation for satisfactory performance under the exacting conditions of industrial and commercial heating requirements everywhere.

SAVE SPACE—They are well adapted to installations where floor and wall space is at a premium. For example, in modern supermarkets they release all shelf and floor space for profitable display and traffic use. Likewise, in factories they do not interfere with machinery, stock bins or materials handling systems.

Railroad Roundhouses

Steel Fabricating Shops



fedders
Unit Heaters

COMPACT, EFFICIENT HEATING—The photographs show typical installation of Fedders Vertical and Horizontal Unit Heaters under a wide variety of conditions where comfort is essential in the working zone.

HEAT TRANSFER SPECIALISTS SINCE 1896—The performance of Fedders Unit Heaters is the result of over 50 years of specialized experience in designing and manufacturing heat transfer equipment. Fedders products are widely used in the automobile, electric refrigeration, air conditioning and heating fields.

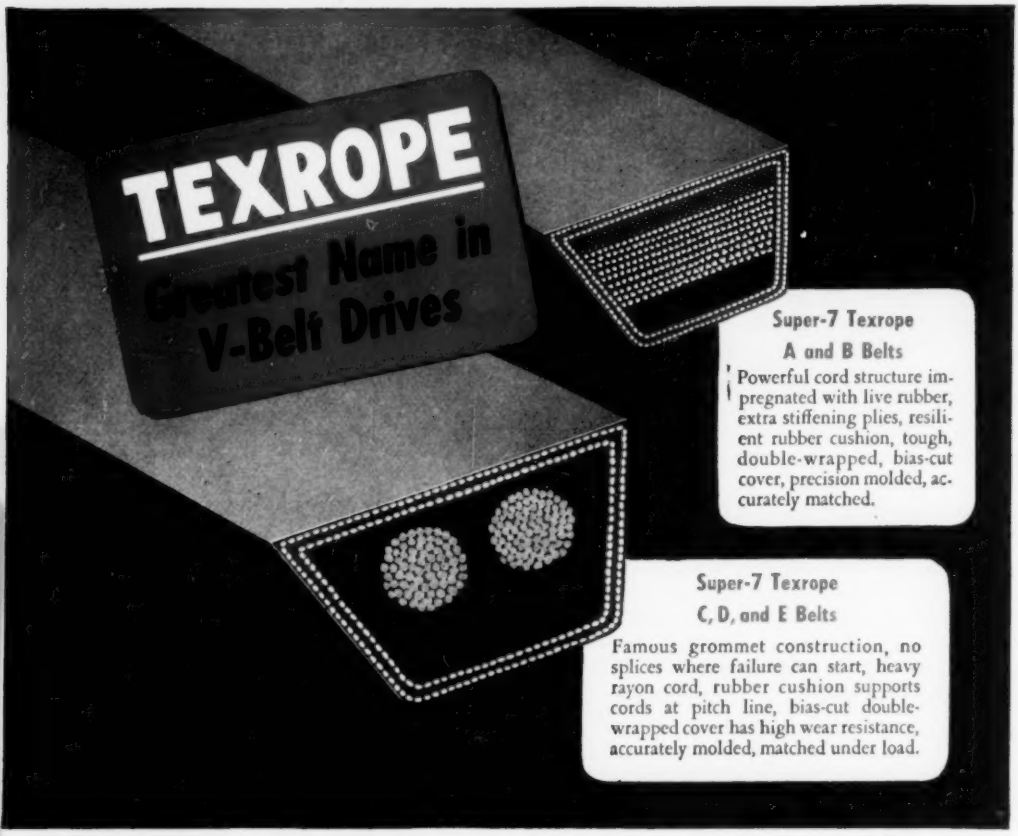
Write today for Fedders Catalogs.

other fedders heating products for home and industry

FEDDERS-QUIGAN CORPORATION

BUFFALO 7, N. Y.

Machine Shops *Automobile Showrooms* *Automobile Service Stations*



Super-7 Texrope
A and B Belts

Powerful cord structure impregnated with live rubber, extra stiffening plies, resilient rubber cushion, tough, double-wrapped, bias-cut cover, precision molded, accurately matched.

Super-7 Texrope
C, D, and E Belts

Famous grommet construction, no splices where failure can start, heavy rayon cord, rubber cushion supports cords at pitch line, bias-cut double-wrapped cover has high wear resistance, accurately molded, matched under load.

LONG LIFE FOR YOUR DRIVES

YOU GET MORE than good belts when you standardize on *Super-7 Texrope* V-belts in your plant. You also get the benefit of the greatest V-belt experience in the world. This means you are sure of exactly the right drive for longest life on your job. *Texrope* Drive Department of Allis-Chalmers originated the multiple V-belt drive and there are more *Texrope* multiple V-belt drives in operation than any other make.

High Capacity Belts

These belts have extra strong cords, special rubber cushion and tough neoprene cover to give them 40% greater capacity than standard belts at proportionately higher price. Recommended only for applications where space is limited or other special conditions demand a heavier duty belt. Made in A, B, C, D and E sections.

Complete V-belt Service

Get everything you need for your V-belt drives . . . new and replacement V-belts, standard and variable speed sheaves and speed changers . . . from one reliable source. 144 page *Texrope* Pre-engineered Drive manual covers 90% of requirements. Get your copy today from your A-C Authorized Dealer or Sales Office or write for Bulletin 20B6956.

Texrope and *Super-7* are Allis-Chalmers trademarks. *Super-7 Texrope* V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

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Sold . . .
Applied . . .
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by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

IN THE REFRIGERATION FIELD,

the surest and safest way to prevent fittings leaks is to install W-S Double-diamond Screw End and Socket Weld Forged Steel Fittings.

Designs are carefully engineered. Basic Materials are selected from a wide choice of carbon, stainless and alloy steels. Drop forging and precision machining makes them light in weight, assures accuracy of finish, and, all are instrument inspected for perfection of threads, sockets, angles and concentricity. Investigate them today.

Write for Bulletin A3-50. For information on stainless and alloy steel fittings ask for Bulletin S-1.

SOLD THROUGH LEADING DISTRIBUTORS EVERYWHERE

SPECIFY...

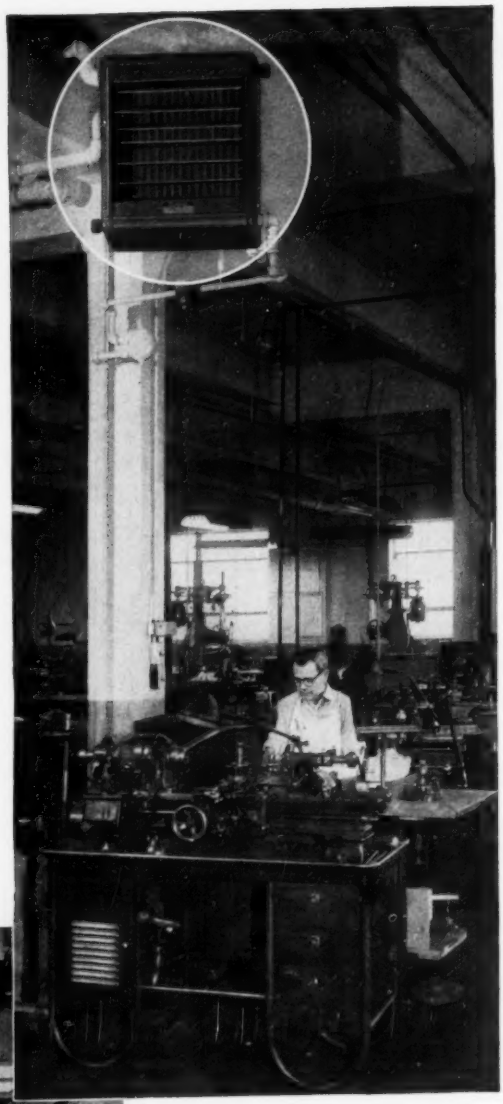
W-S

FORGED STEEL FITTINGS

DISTRIBUTORS PRODUCTS DIVISION **WATSON-STILLMAN** ESTABLISHED 1848 • ROSELLE, NEW JERSEY

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

SOLVE YOUR HEATING PROBLEM NOW... EFFICIENTLY, ECONOMICALLY



Precision instrument machine shop where Speedheater installations provide even distribution of warm air.

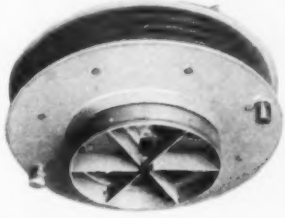
Speedheater installed to blanket door opening. This minimizes heat loss as door opens frequently.

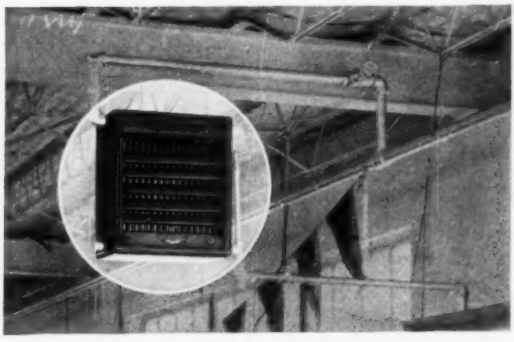
From basements to warehouses, from drying rooms to bus terminals, Sturtevant Speedheaters® offer the efficient, economical answer to your heating problem. Speedheaters provide faster heat delivery, better heat distribution, lower fuel costs. They do what old style heating systems fail to do . . . force warm air *down* into working areas where it is needed most. Adjacent walls are "washed," not "baked" with heat, giving more uniform distribution over larger areas. Speedheaters go to work immediately; there's no "warm-up" time and fuel lost.

Call your plumbing and heating contractor today for details on the Speedheater, or write Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.

FOR HIGH CEILING INSTALLATIONS—
THE DOWNBLAST SPEEDHEATER

Forces warm air down into working area; greatly reduces ceiling heat loss; connections on both sides save piping costs; capacities from 40,000 to 400,000 btu.





Installation showing simple plumbing connection.

CHECK THESE FEATURES AND SEE WHY SPEEDHEATERS ARE YOUR BEST BUY:

1. *Fast Heat Delivery . . . with quiet-operating fan.*
2. *Low Maintenance Cost . . . single row radiator assures uniform tube expansion, freedom from radiator distortion. Each heater tested for 200 lbs. steam pressure.*
3. *Dependable long-service Westinghouse Motor . . . backed by nation-wide motor service plan.*
4. *Simplified Installation . . . Flat top construction permits installation directly to the ceiling . . . inlet and outlet connection on each side of heater.*
5. *Pliable Steel Hangers . . . can be shaped on the job.*
6. *Available in 26 Sizes . . . from 25,000 to 400,000 btu.*

YOU CAN BE SURE...IF IT'S

Westinghouse

J-80199A

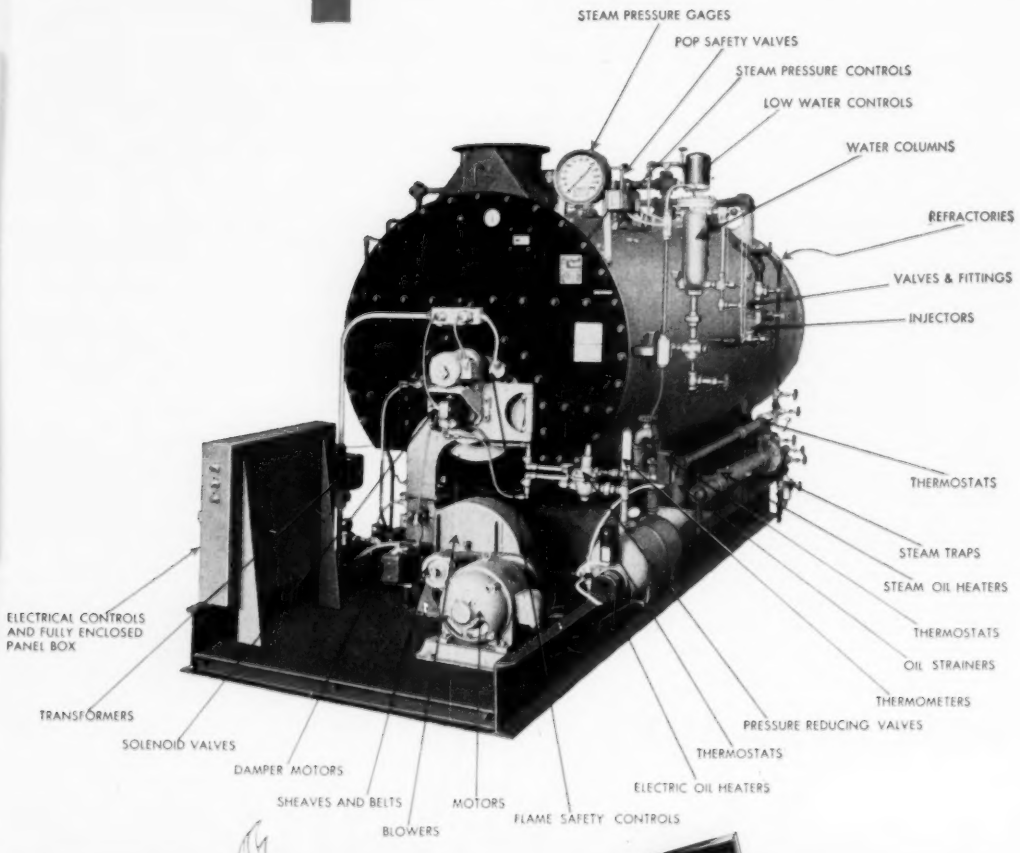
Matched quality components

another reason why you get a greater return from your investment in a Cleaver-Brooks Steam Boiler

Cleaver-Brooks steam boiler quality is the sum of many qualities. From the rolling-in of the first tube and through every step to completion, the highest standard of engineering, material and workmanship prevail. Every component is the tested product of a manufacturer of known standing — carefully selected by Cleaver-Brooks engineers through test and research.

Your Cleaver-Brooks boiler is the end-product of many specialized engineering talents and manufacturing skills. When you install Cleaver-Brooks you have a steam boiler of foremost quality — with immediate and long-range cost-saving advantages. Cleaver-Brooks self-contained Boilers — 15 to 500 HP 15 to 250 lb. p.s.i.— for oil, gas, combination oil and gas firing.

CLEAVER-BROOKS CO., 367 E. Keefe Ave., Milwaukee 12, Wis.



Cleaver-Brooks

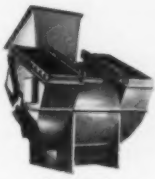
STEAM BOILERS

NEW — The Cleaver-Brooks Steam Boiler Catalog — interesting — informative — beautifully illustrated. Write — on your business letterhead for your copy — no obligation.

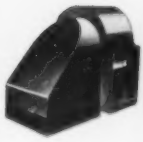
American Blower—a time-honored name in air handling

In Indianapolis, as in other cities, American Blower Air Handling Products serve commerce, industry and public utilities. For air handling data in the Indianapolis area, call American Blower—Riley 4521. Elsewhere, consult your phone book.

Venturafin Unit Heaters



Mechanical Draft Fans



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Ventura Ventilating Fans

Dust Collectors

Air Washers

Industrial Fans

Heating and Cooling Coils

Air Conditioning Equipment

Look before you buy and you'll buy American Blower Air Handling Products. There's a big difference in quality, design, quietness, operating costs and efficiency. The superiority of American Blower products has been proved in test after test by buyers.

Air is free . . . use it profitably!

THERE is a big difference in air handling equipment—quality of workmanship, performance and cost of operation, as well as experience and integrity of the manufacturer.

Take testing for example. All American Blower Air Handling Equipment is tested in accordance with the Standard Test Code as adopted by the American Society of Heating and Ventilating Engineers. All ratings are Certified.

These tests are being made continuously in our own laboratories built exclusively for the purpose and containing every known modern type of equipment for research and testing.

To buyers of air handling equipment, this insures uniform high quality and long, dependable service at low cost.

To contractors with an eye to the future, this same careful attention to detail and high standards assures satisfied customers and satisfactory profits.

Our nearest branch office will give you full data.

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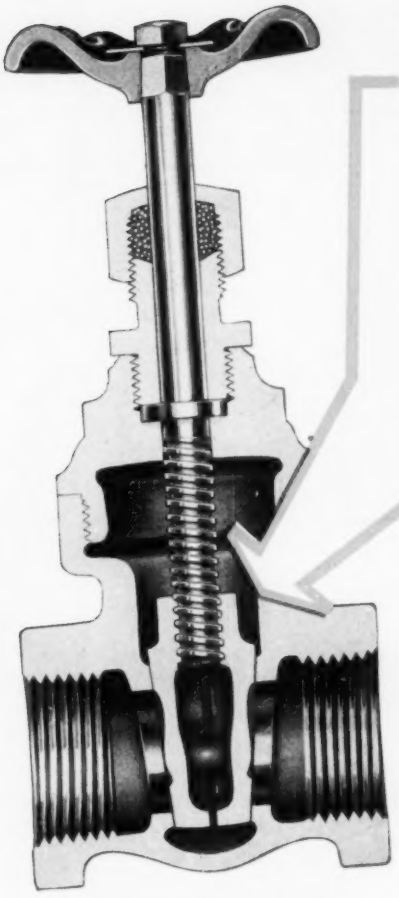
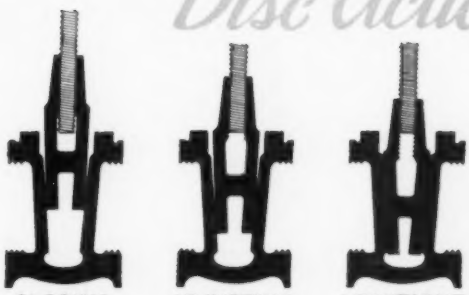


SQUEEZE PLAY
Disc Action



Makes O-B Gate Valves --
LEAKTIGHT . . .

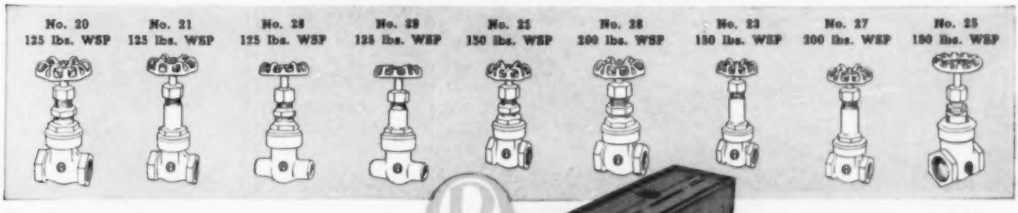
Not even gasoline or light oil can get by the O-B Flexitite Disc®. Due to its special split-wedge design, the outer edges of the Flexitite Disc have a slight springing action, which permits the disc to be squeezed slightly between the seat faces. This springing action (exaggerated above) enables the disc to adjust itself and conform perfectly to the matching surfaces of the seat. Minor irregularities are thus nullified and the perfect metal-to-metal seal yields 100 per cent leaktight closure on all types of general service.

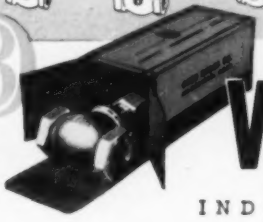
COMPLETE LINE OF VALVES

In addition to gate valves, your local Ohio Brass Distributor carries a complete line of O-B globes, angles, checks, and special valves for low and standard pressure lines.

OHIO BRASS CO. MANSFIELD, OHIO

4025-V





Ohio Brass VALVES

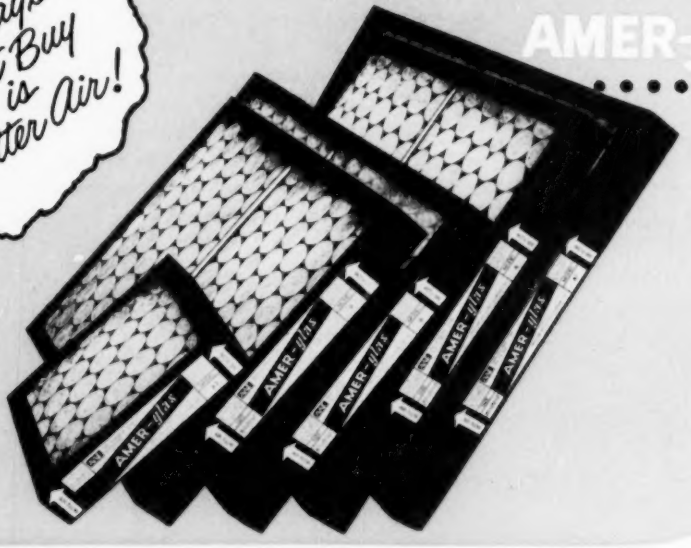
FOR DOMESTIC AND INDUSTRIAL USE

HV-2

use the filter that fits the job

Today's Best Buy is Better Air!

AMER-glas



American Air Filter Products Include: Roto-Clone Dust Collectors, Airmat Dust Arrestors, Electromatic, Electro-Cell, Electro PL, Electro-Klean Electronic Precipitators, Multi-Duty Self-Cleaning, Airmat PL Units, MW & HV Permanent Units, Amer-glas Replaceable Filters, Cycoil Oil Bath Cleaner, Herman Nelson Division —Quality Heating & Ventilating Equipment

. . . the high-velocity, low resistance filter

AFTER months of painstaking research in high velocity air cleaning, AAF now brings you the HV-2. Its pyramid-pocket media design prevents any direct-through passage of air. It has a wide velocity range operating efficiently with velocities up to 500 f.p.m.

The wire screen media is arranged in irregular series, forming pockets. These prevent dislodging of collected material by vibration and consequent entry of dirt into the air stream. Large dust capacity, low resistance, uniform efficiency and extra long life with extreme adaptability make AAF's HV-2 the high-velocity filter of distinct advantages, dependable under widely varying conditions.

. . . . . replaceable filter

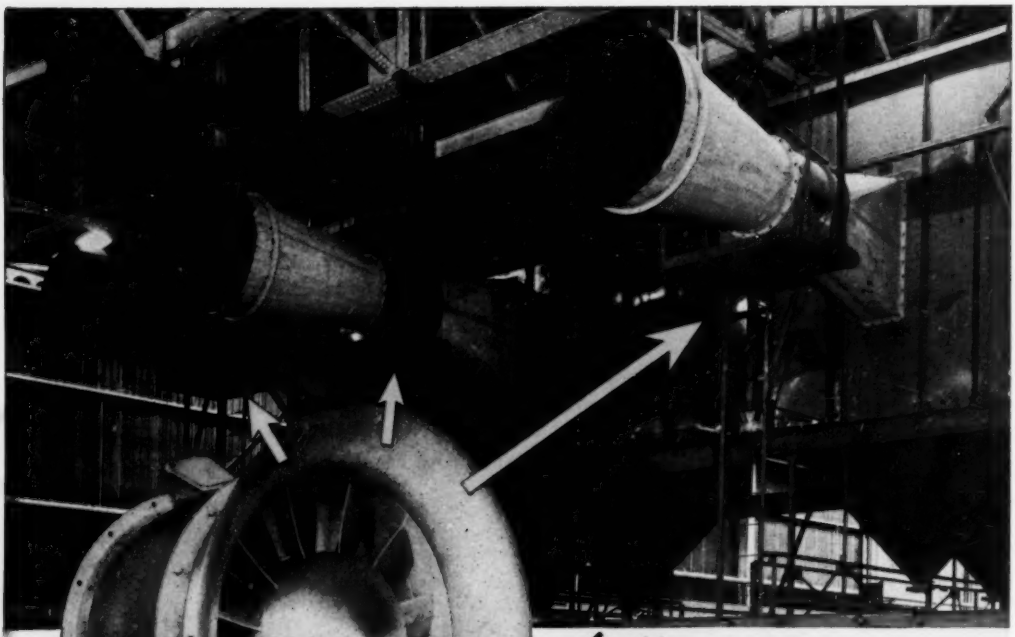
IT'S the talk of the industry! It's something new in AAF's complete line of every kind of air cleaning equipment. AMER-glas uses a media of continuous strands of glass filament. Arranged as a resilient, thick pad, bonded with thermo-plastic, made non-flammable by a coating of special Viscosine—AMER-glas sets new standards of high quality.

Send for prices. Standard sizes are ready for shipment now. You'll find the clean-cut, jobber-dealer selling plan can be profitable in your growing replaceable filter market.

Write now for complete information on AAF products to:

American Air Filter
COMPANY, INC.

373 Central Avenue, Louisville 8, Kentucky • ***In Canada:*** **Darling Bros., Ltd., Montreal, P. Q.**



What's your ventilation job?

JOY AXIVANE* FANS

WILL DO IT MORE EFFICIENTLY AND MORE ECONOMICALLY!

Write for Bulletin, or *Consult a Joy Engineer*

From every possible angle, JOY Series 1000 AXIVANE Fans will give you a better, lower-cost job. Their inline, vane-axial design is lighter and more compact; and they operate more quietly, require less power and space, and save greatly on installation time and costs. What's more, you get the extra flexibility of adjustable blades—a standard JOY feature—permitting easy and quick on-the-job regulation of pressure or volume over a wide operating range, with positive protection against motor over-load.

Whatever your job is, JOY AXIVANE Fans can show you advantages—let us work with you.

*Reg. U.S. Pat. Off.

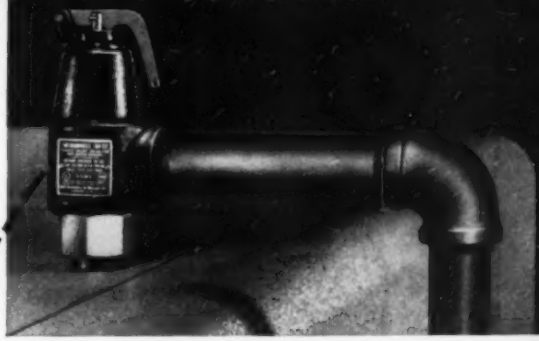
W&D 12356

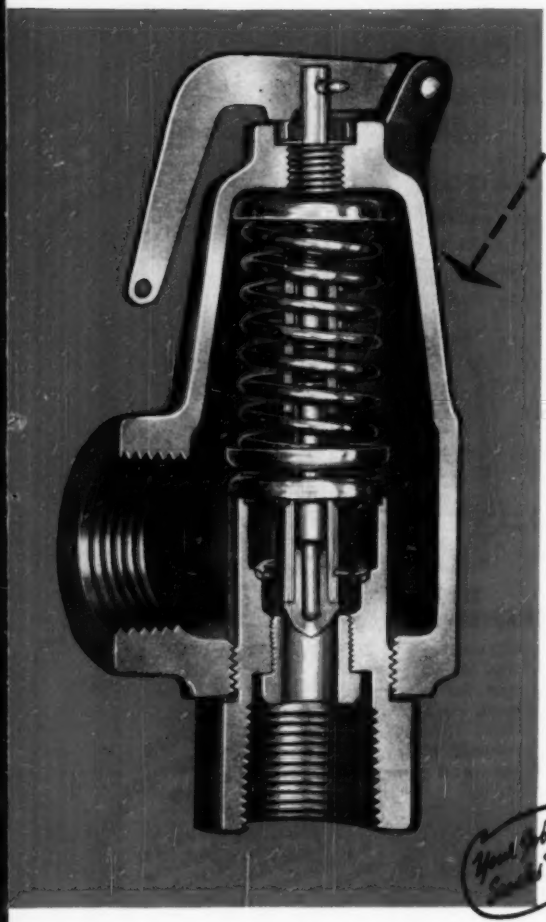
JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

Thousands of installations tell the story:





Your Jobber Sells Them

Actual size — the little valve of big capacity: 242,900 Btu. per hour.

A.S.M.E. Standard—tested by National Board of Boiler and Pressure Vessel Inspectors; certified by A.S.M.E.

Moderately priced—below that of valves that do not rival its quality.

The McDONNELL No. 33 is your tried and proved, Btu. rated relief valve

The first Btu. rated, A.S.M.E. labelled safety relief valve to be priced within the reach of every boiler owner was the McDonnell No. 33.

And make no mistake about it—it is STILL FIRST!

Faultless service on thousands of hot water heating boilers — unprecedented acceptance by the most discriminating heating men—shows that it was built to the standards that have given new meaning to dependability in all McDonnell boiler safety devices.

In the No. 33 you have a valve with a heat dissipating capacity of 242,900 Btu. per hour—a capacity that will comply with the boiler code requirements for all boilers up to its Btu. rating . . . and this takes care of more than 70% of all hot water heating boilers. It is tested by National Board of Boiler and Pressure Vessel Inspectors; certified by the A.S.M.E. for use of the code symbol and so labelled on the name plate.

But, still more important than this, it is a quality valve all the way through. It carries out the McDonnell mandate of metal-to-metal valve construction — the valve needle hardened stainless steel ground to polished fit; the seat, stainless steel, machined and reamed to close tolerance. All working parts are corrosion resistant. A typical refinement is the testing lever which is easy to lift under all conditions and operates independently of the valve so that it is not disturbed by the opening of the valve in service.

Ingenious simplicity, along with elaborate tooling and large scale production, has made it possible to produce a valve of this high quality at a very moderate price. It is the valve you can install with complete confidence. Write for details.

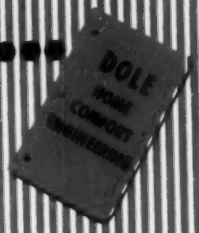
McDONNELL & MILLER, Inc.
3500 N. Spaulding Ave., Chicago 18, Ill.

Note new address

Doing One Thing Well

McDONNELL *Boiler Safety Devices*

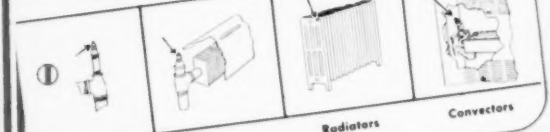
Here's One for the Book...



FULLY AUTOMATIC

DOLE-20

Dole No. 20 Hot Water Air Valves eliminate air from hot water radiators or convectors AUTOMATICALLY. They work equally well on new or existing heating plants with forced circulation or gravity systems. Easy to install — require no preliminary soaking — fully automatic.



...and Another

DOLE CHAMBER VENT

A combination fully automatic hot water air valve and air chamber. Specially designed for venting convectors, radiators, etc., on hot water heating systems. Three sizes cover most requirements. Write for specification sheets and prices.

...and Another

DOLE FLOW CONTROL VALVE

A simple practical valve to regulate the flow of water. Limits the discharge to a pre-determined gallonage regardless of city water pressure from 15 to 150 lbs. p.s.i. No more cool water from over-drawn tankless heaters. Many other applications.

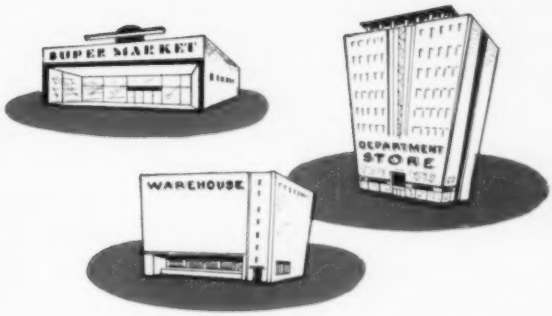
All DOLE Achievements

● CONTROL WITH DOLE

THE DOLE VALVE COMPANY • 1933 Carroll Ave., Chicago 12, Ill.
Representatives in Principal Cities

BRUNNER SINCE 1906 REFRIGERATION helps you serve better

Don't let the size of the job stop you!



Take on Brunner! Take on new business! With Brunner you have a line that sells—something to work with.

√ 40 sizes and types of refrigeration condensing units ranging from close-coupled air-cooled 1/4 hp units to husky 75 hp units for the big commercial jobs.

√ Specify and install with absolute confidence. Brunner's are completely Brunner built . . . known and accepted in every trade and industry as the soundest constructed units money can buy.

√ Dependable supply in any size, type or quantity Brunner facilities have more than *doubled since the war* and still building.

√ Co-operation...both sales and engineering... is yours from a nationwide field organization staffed by men with years of practical, on-the-job experience. These men know your problems and talk your language.

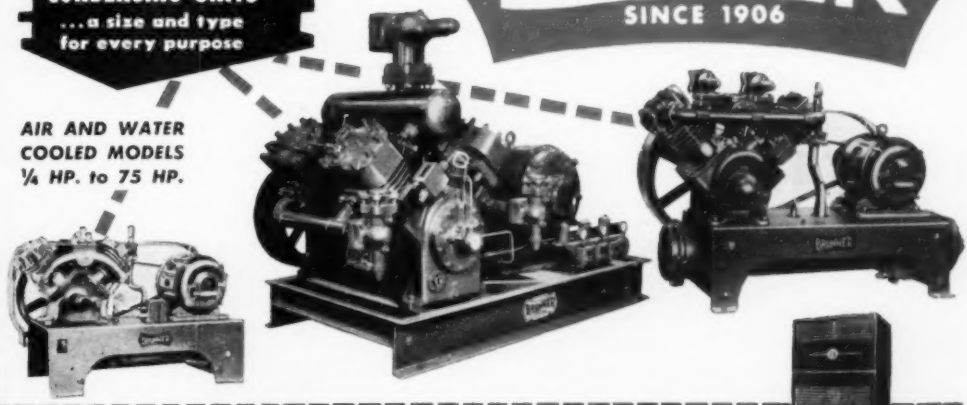
BRUNNER MANUFACTURING CO.
Utica 1, N. Y., U. S. A.

PROFIT MARGINS, markets and technical details are best covered in meeting with a Brunner factory representative. Spend a little time with him. See what Brunner can contribute to your better business. When do you want to see him?

REFRIGERATION CONDENSING UNITS
...a size and type for every purpose

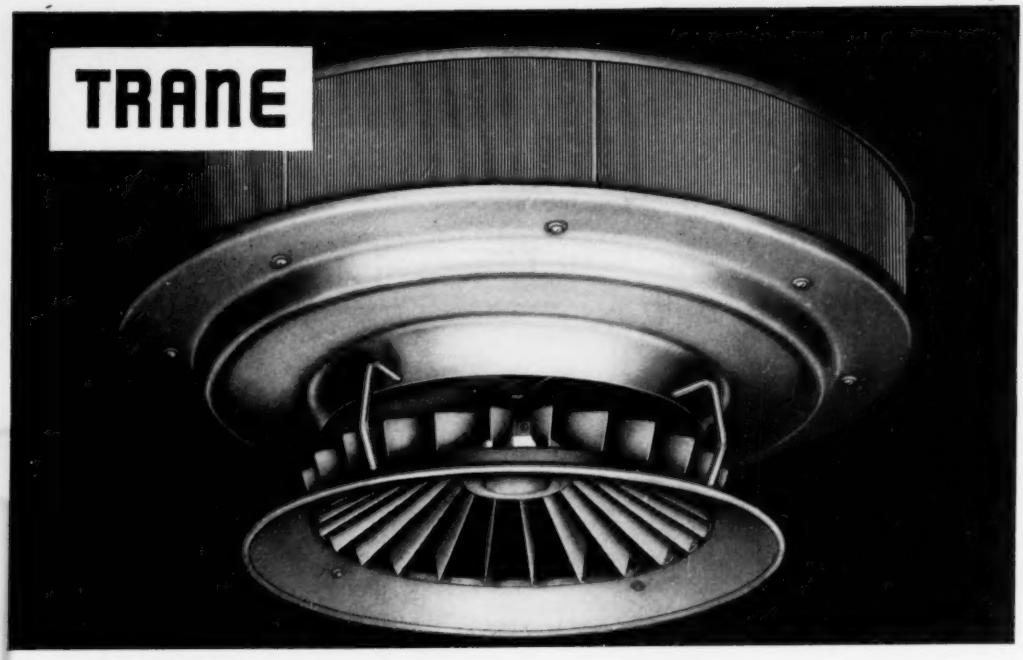
BRUNNER SINCE 1906

AIR AND WATER COOLED MODELS
¼ HP. to 75 HP.



BRUNNER SINCE 1906

AIR CONDITIONING
Self Contained Units in 4 sizes: 3 - 5 - 7½ and 10 HP.
Remote Installation Types from 5 to 75 HP.



New Heater, New Diffuser, New High in Heating

Put warmth right where you want it with the new Trane Projection Heater—Louver Cone Diffuser team. Whether in a rolling mill or a restaurant it's double trouble for cold.

The Projection Heater with its modern design and new contoured casing is now more eye-pleasing than ever. Better for more commercial applications—still best for industrial installations. The Trane circular coil is improved, too, providing more heat under higher pressures than ever before. Hydraulically expanded at *more than 3,000 pounds pressure* for added insurance of a leakless lifetime.

The new Louver Cone is a *completely adjustable* diffuser made exclusively for the Projection Heater. Adjusted with just a simple flick of the finger, it provides a pattern of heat diffusion that is virtually tailored to the requirements of each projection heater location. For real unit heating flexibility, the Louver Cone *controls* heat flow, divides it, spreads it, aims it—sending heat in two or more directions at once—blanketing drafty areas—pin-pointing cold spots with comfort—throwing heat up to 60% farther.

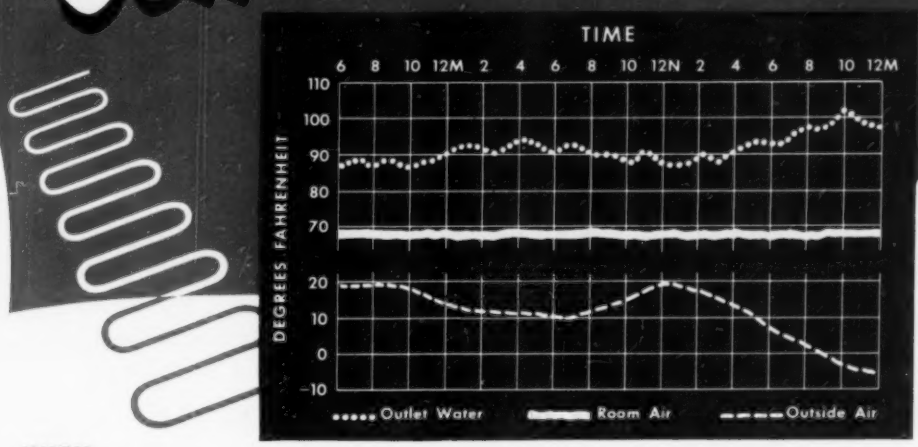
For more information on all types of horizontal and vertical discharge unit heaters, contact your nearest Trane representative.

THE TRANE COMPANY...LA CROSSE, WIS.
EASTERN MANUFACTURING DIVISION, SCRANTON, PA.

Manufacturing Engineers of Heating, Ventilating and Air Conditioning Equipment—Unit Heaters, Convector-radiators, Heating and Cooling Coils, Fans, Compressors, Air Conditioners, Unit Ventilators, Special Heat Exchange Equipment, Steam and Hot Water Heating Specialties ... IN CANADA, TRANE COMPANY OF CANADA, LTD., TORONTO.

Smoke tests show how the Trane Louver Cone Diffuser tailors the air flow to fit every application perfectly. Write for Bulletin S-327B, "The Story of Diffusion."

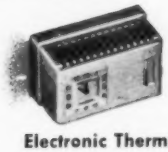
"Pin-Point" Control for PANEL HEATING



WITH HONEYWELL ELECTRONIC MODUFLOW

Electronic Relay Amplifier

Outdoor Anticipator



Electronic Thermostat

HERE'S actual proof of "Pin-Point" control for panel heating—actual results obtained from independent scientific tests during installation of a typical domestic radiant floor paneling application. Room temperatures were held within a fraction of 70°, despite extreme variances in outside temperatures!

At the slightest temperature change, every sensing element in Honeywell's Electronic Moduflow responds instantly. There's no time lag — no chance that room temperature will fluctuate as with mechanical controls. Overcome is the slow response that occurs when any radiant panel is enclosed in concrete.

Electronic Moduflow means dependable automatic comfort from every radiant panel, properly designed and installed. It means the ultimate in accurate control.

Two interesting booklets about Electronic Moduflow have been prepared by Honeywell. They are entitled: "Electronic Moduflow," and "Electronic Moduflow in Radiant Panel Heating." Send for your copies, today! Minneapolis-Honeywell, Minneapolis 8, Minnesota. In Canada: Leaside, Toronto 17, Ontario.

FREE

To get the booklets offered above, simply ask for numbers S A 1447 and 1499. Phone your local Honeywell office or address Minneapolis - Honeywell, Minneapolis 8, Minn.

MINNEAPOLIS **Honeywell**

FIRST IN CONTROLS

77 BRANCHES FROM COAST TO COAST WITH SUBSIDIARY COMPANIES IN: TORONTO • LONDON • STOCKHOLM • AMSTERDAM • BRUSSELS • ZURICH • MEXICO CITY

Everything had to be perfect in this home of architect Frederick Stritzel, of Columbus, Ohio. That's why, when it came to the important radiant heating system, he specified rugged Bundyweld —the perfect tubing for the job. *Heating contractor, Piping Contractors Company. Tubing supplied by Capital Heating & Equipment Company.*

Architect picks Bundyweld for radiant heating in own home

It's top praise for top tubing when professionals like F. Stritzel pick Bundyweld Tubing for radiant heating systems in their own homes.

Yet, look where you will—check them *all*—you'll find no other tubing that offers as many advantages for radiant heating in your building projects as Bundyweld.

It's the only tubing double-walled from a single strip, a patented construction that makes it stronger, lighter, more leakproof.

It's quickly, easily fabricated by hand—no special bending fixtures needed. It's installed in a jiffy (and in to stay!). And it takes the knocks and jolts in a building operation without weakening or buckling. Remember, too: Bundyweld's thinner, ductile walls, with their complete copper bond, always afford maximum heat conductivity.

What more could you ask for in a radiant heating tubing? From the moment Bundyweld arrives on your building site, you start to save and improve on your job. Installations are quicker, costs are down, performance is up. You owe it to yourself to check Bundyweld *first*.

Write today for the new Radiant Heating Brochure. ***Bundy Tubing Company, Detroit 14, Michigan.***

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

HEATING FOR A HOUSETIME

WHY BUNDYWELD IS BETTER TUBING

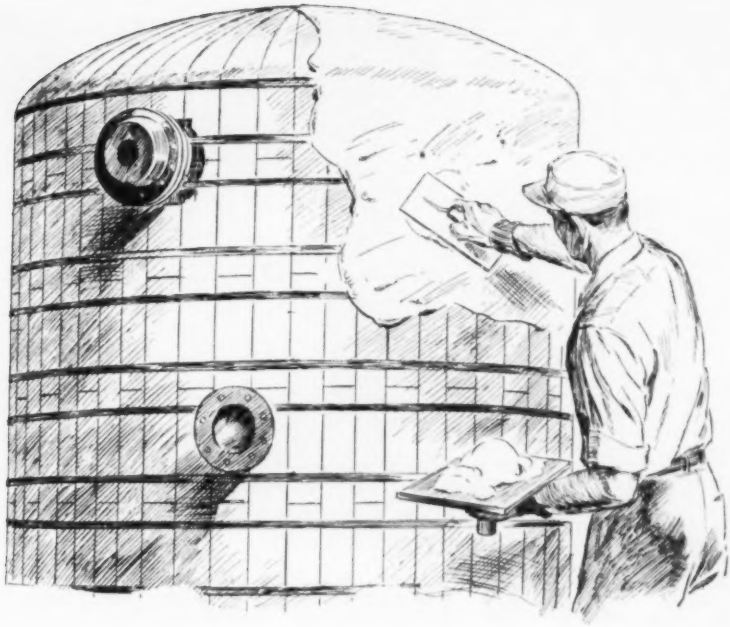
Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Bonding metal fuses with basic metal, presto—

Bundyweld . . . double-walled and brazed through 360° of wall contact.

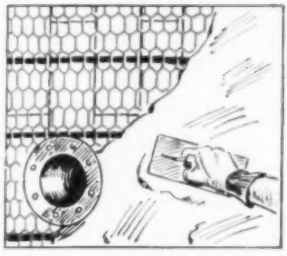
NOTE the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any breakage.



What's wrong with this picture?

Here is a workman applying cement finish over the insulation on a boiler water heater, but he has omitted one very important step. For a good job, a layer of hexagonal wire mesh should have been placed over the insulation before the cement finish was applied. Here's why this is important.

Over very small areas, insulating cements will adhere well enough to heat insulating materials. But on larger equipment and fittings, even though some key is afforded by bands or wires that hold the insulation in place, this is far from sufficient to anchor the finish for any length of time. A layer of wire mesh provides the key necessary for a tight job. It also distributes evenly the effects of expansion and contraction after the equipment goes into operation, thus reducing cracks in the finish.



The wire mesh over insulation on larger size equipment is just an example of how unseen details can add to the efficiency and life of a heat insulation job. Being sure every detail, both seen and hidden, is done right is one of the things you can count on when you hire a reliable contractor. Armstrong has established a reputation for reliable workmanship, and close attention to detail.

When you call on Armstrong's contracting organization you get the expert engineering advice and skillful application of high-quality insulation that insures a good job. Why not ask Armstrong for an estimate on your next heat insulation work? There's no obligation. Just phone the Armstrong office nearest you or write to Armstrong Cork Co., 4409 Maple Ave., Lancaster, Pa.

ARMSTRONG'S INDUSTRIAL INSULATIONS

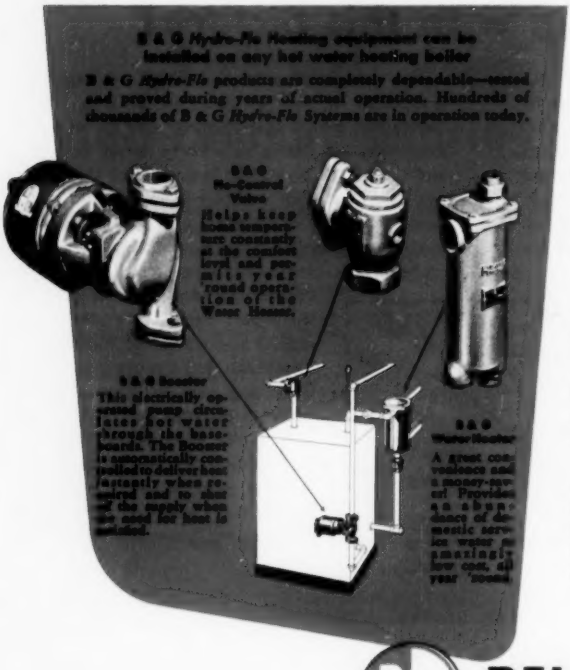
MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.

Plenty of hot water for showers and automatic washers . . . all year 'round

PLUS B&G *Hydro-Flo* Heating

A SALES-MAKING COMBINATION OF WINTER COMFORT AND HOME BEAUTY


B & G Hydro-Flo Heating equipment can be installed on any hot water heating boiler
B & G Hydro-Flo products are completely dependable—tested and proved during years of actual operation. Hundreds of thousands of B & G Hydro-Flo Systems are in operation today.
B & G No-Control Valve
Helps keep home temperature constantly at the comfort level and permits year 'round operation of the Water Heater.
B & G Booster
This electrically operated pump circulates hot water through the baseboards. The Booster is automatically controlled to deliver heat instantly when required and to shut off the supply when no need for heat is indicated.
B & G Water Heater
A great convenience and a money-saver! Provides an abundance of domestic service water at amazingly low cost, all year 'round.

B & G *Hydro-Flo* Forced Hot Water Heating with radiant baseboards offers three great selling advantages.

First, amazingly smooth and accurate control of indoor temperature. You don't open windows to regulate the temperature in a home with B & G *Hydro-Flo* Heating . . . the system automatically adjusts the heat supply to meet every change in the weather. No overheating, hence, no fuel wasted.

Second, *radiant sunny warmth* from heating units which look like conventional wooden baseboards *and are just as unobtrusive!* Radiant baseboards distribute heat so evenly that from floor to ceiling, the temperature hardly varies. Always uniform, draftless heating!

And finally, an all-year supply of hot water for kitchen, laundry and bath, *heated by the same boiler that heats the house.* Plenty for automatic washers . . . and so low in cost it can be used unsparingly.

BELL & GOSSETT *Company*

Dept. BS-5, Morton Grove, Illinois

Canadian Licensee:
S. A. Armstrong, Ltd., 1400 O'Connor Road, Toronto, Canada

*Reg. U. S. Pat. Off.

ACCURACY

not for its own sake but because it

Reduces your Piping Costs

Exceptional dimensional accuracy and uniformity of Midwest Welding Fittings speeds piping work and reduces cost. All pipe can be cut in advance according to drawings, with assurance of accurate fit. Welders do not have to spend costly time struggling to line up fittings and pipe. Welding proceeds rapidly, economically with no time-wasting compensation for inaccuracies.

All critical dimensions of Midwest Fittings are accurate and uniform. For example, Midwest Welding Elbows are first made slightly oversize. They are then reheated to forging temperature and brought to final size in compression dies. In addition to relieving stresses from forming and welding, this assures true circular cross-section, controlled wall thickness and accurate radius, included arc and tangents. Midwest Elbows and Tees have accurate welding bevels, included angles, etc., because all ends are machined simultaneously in special machines.

There is a Midwest Distributor near you. Get in touch with him for your fitting needs. Also ask for Catalog 48.

4098

MIDWEST

PIPING & SUPPLY COMPANY, Inc.

MAIN OFFICES: 1450 SO. SECOND STREET, ST. LOUIS 4, MO.

Sales Offices: New York 7—30 Church St. • Chicago 3—79 W. Monroe St.
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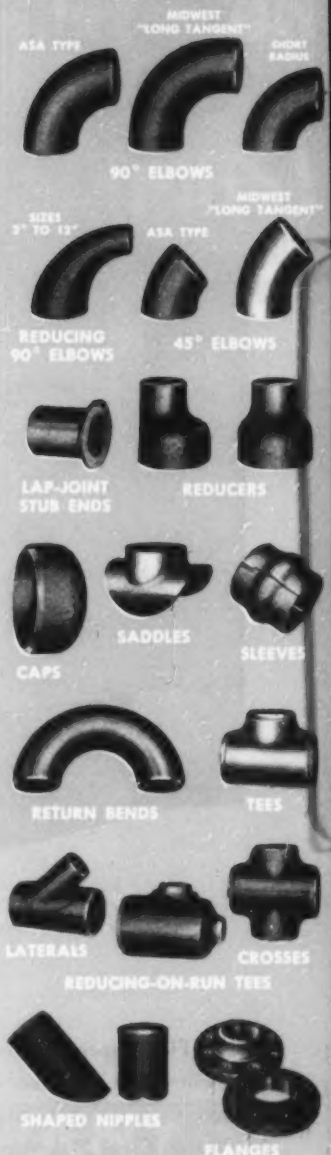
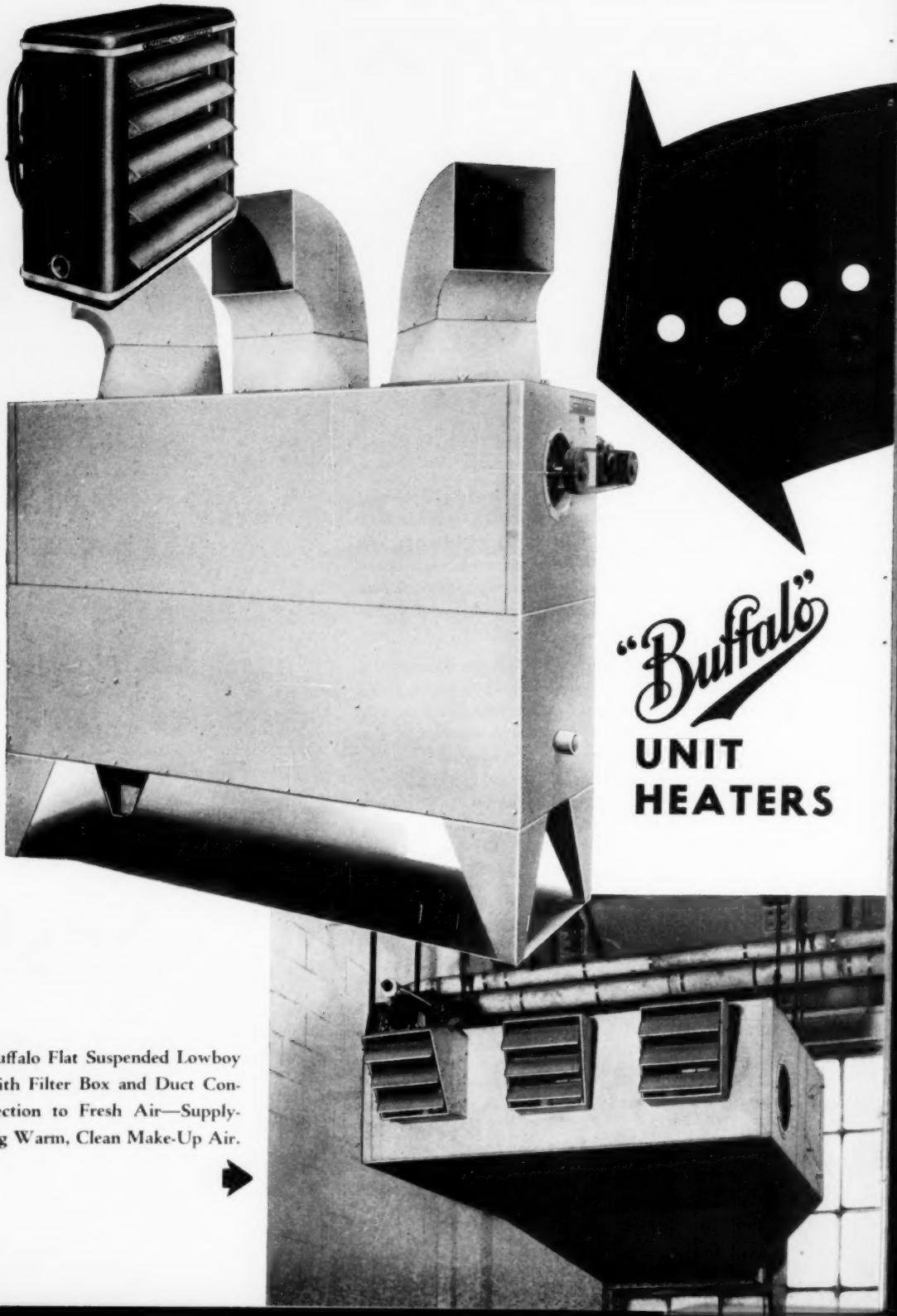
Tulsa 3—533 Mayo Bldg. • South Boston 27—426 First St.
Stocking Distributors in All Principal Cities

MIDWEST WELDING FITTINGS Improve Piping Designs and Reduce Costs





"Buffalo"

UNIT HEATERS

Buffalo Flat Suspended Lowboy with Filter Box and Duct Connection to Fresh Air—Supplying Warm, Clean Make-Up Air.

PLAN EFFICIENT HEAT DISTRIBUTION WITH THESE SPACE-SAVING UNITS!

NOW is the time to make plans for adequate plant heating next winter! "Buffalo" BREEZO-FIN HEATERS, top left, operate on 2 to 100 lbs. steam pressure, have efficient "Buffalo" BREEZO FANS and adjustable louvers to throw plenty of heat just where you want it. For suspended installation, taking no floor space. 20 sizes. And for large floor areas, "Buffalo" HIGHBOY and LOWBOY HEATERS provide both healthful heating and ventilating. Standard, sectionalized construction allows moving all units into your building through standard doorways. Ideal for duct distribution.

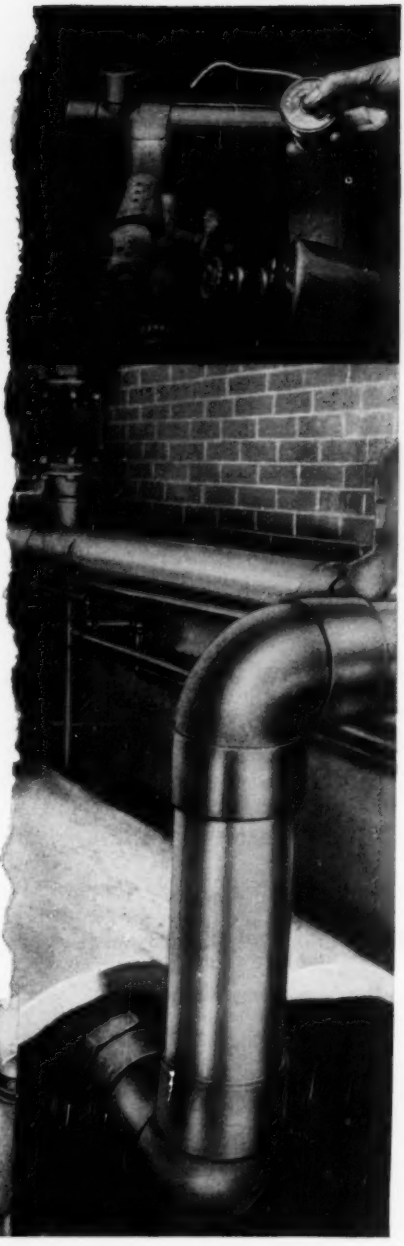
WRITE FOR DETAILS NOW—be ready for winter heating problems!

BUFFALO FORGE COMPANY

171 Mortimer St., Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

No. 5 / Quick Quiz on Copper Piping



Q What evidence is there of copper tube's satisfactory performance in heating systems?

A The substantial, growing trend to use copper tube in all types of heating systems, notably forced-circulation hot water and radiant panel heating.

Q What are some of copper tubing's advantages?

A Durability, flexibility, light weight, labor savings and low total cost.

Q What about freezing?

A Try to avoid it, but remember that soft annealed ANACONDA Copper Tubes are highly ductile and can usually withstand several freezings with little possibility of damage.

Q Can you tell me more?

A

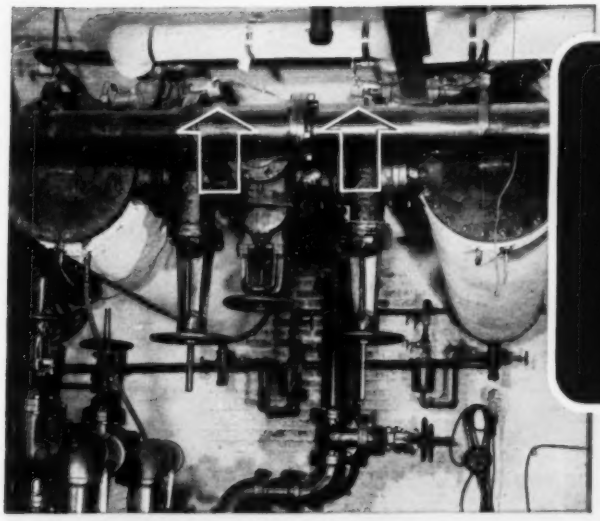
Lots more. Just send for Bulletin C-24—full of useful data about ANACONDA Copper Tubes and their many industrial applications. Just write The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

For better Piping . . . use

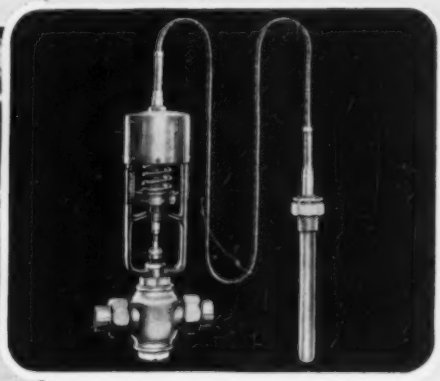
ANACONDA®

COPPER TUBES

"Efficiency Expert" for oil-fired boilers!



Steam supply to fuel oil pre-heaters under constant control by Sylphon Regulators—assuring ideal burner operation in all seasons.



Sylphon Temperature Regulator No. 923-5 illustrated—valve sizes from ¼" to 1½". Sylphon Safety Regulators No. 955, 956 and 955-HK (not illustrated) protect oil fired boilers or furnaces by automatically shutting off oil supply if atomizing pressure fails.

Sylphon Temperature Regulator helps assure ideal burner operation

Wherever it is necessary to pre-heat fuel oil, Sylphon Regulators can help maintain oil temperature that assures maximum combustion efficiency. And they do the job automatically – dependably – constantly.

These simply-constructed, sturdy, self-operating Regulators are installed on the steam supply lines to the pre-heaters. The Regulator bulb is placed in oil leaving the heater. Highly sensitive, the bulb instantly activates the Regulator if temperature changes. Steam flow is promptly regulated to maintain the fuel oil temperature desired.

Regulator No. 923-5 has "stable" modulating control characteristics; there's no cycling or hunting in the discharge temperature. What's more, it has built-in, over-temperature protection; the thermostat assembly is safe-guarded against damage in the event the bulb is subjected to above-limit temperatures.

Write for details about Sylphon Regulator No. 923-5, or for information on the full line of Sylphon Regulators for temperature and pressure control. Ask for Catalog RH-A.

FS

FIRST WITH BELLOWS

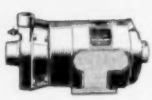
Temperature Controls • Bellows Devices • Bellows Assemblies

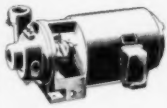
FULTON SYLPHON
DIVISION

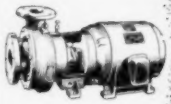
ROBERTSHAW-FULTON CONTROLS CO., KNOXVILLE 4, TENN.

Canadian Representatives, Darling Brothers, Montreal

ALLIS-CHALMERS
PACKAGE PUMPS


SSR Fractional hp.


Electrifugal 1 to 10 hp..


SSU 10 to 125 hp.

Plenty of room for maintenance

LOOK AT THE SPACE between the pump and motor on this *Electrifugal* pump. Packing maintenance or replacement is quick and easy, yet rigidity of the frame has not been sacrificed. You save time and money on maintenance. You get a better packing job because your maintenance man has room to work.

Maintenance procedures on bearings have been eliminated altogether. Bearings are sealed with just the right amount of the correct grease. They cannot be over or under lubricated. Bearings are protected from liquid by a new type of double bearing seal that excludes all liquid under any normal operating condition.

All cast iron frame construction for rigidity and corrosion resistance... smooth contours for pleasing appearance and easy cleaning . . . replaceable wearing rings . . . shaft sleeves . . . are other high quality features that make A-C package pumps deliver low cost per gallon pumped.

COORDINATED DESIGN

Pumps and motors are designed, built, assembled and tested in the same plant to work together to give you more for your pump dollar. Competent application engineers help you select exactly the right pump for your needs and a nation-wide network of Certified Service Shops helps you keep your pumps in top condition.

Get details on the cost cutting A-C Package Pump for your application from your A-C Authorized Dealer or Sales Office. Or write for Bulletin 52B6140. A-3062

ALLIS-CHALMERS, 1171A SO. 70 ST. MILWAUKEE, WIS.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

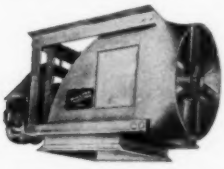
Texrope, Vari-Pitch and *Electrifugal* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

WING VENTILATING EQUIPMENT

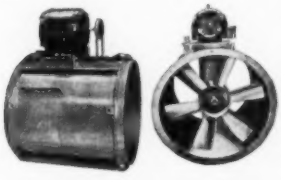
WINGFOIL SAFETY VENTILATING FAN

Distinguished for efficiency and rugged construction. The new Wingfoil fan wheel moves maximum volumes of air with minimum horsepower, due largely to its non-overloading feature. Sizes from 10" to 60" dia., with free air capacities from 825 to 59,000 CFM. Larger sizes on special order. Either direct or belt drive. Heavy steel guards provide safety.



WINGFOIL DUCT FAN
(Elbow Type)

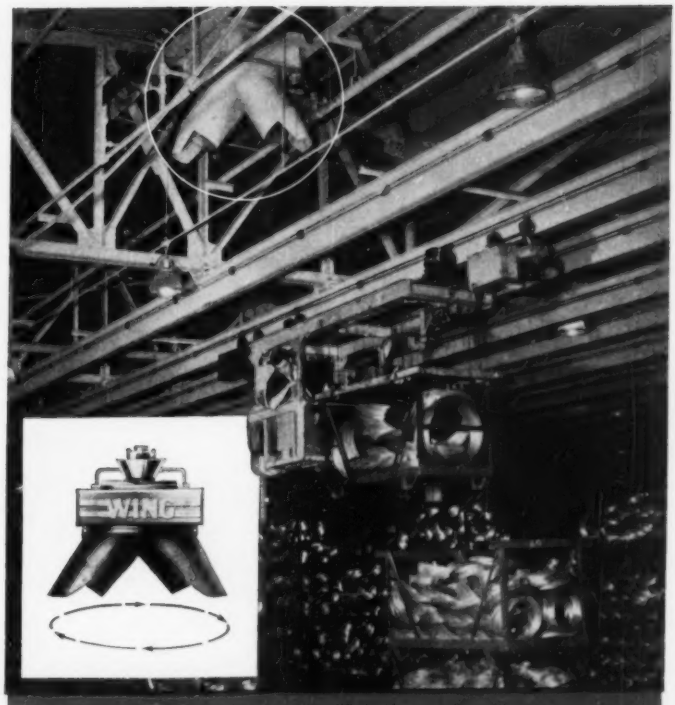
Designed to form an elbow in the duct system, the elbow-shaped housing in a strong rectangular frame permits installation with the inlet in any desired position. Motor and drive are outside the air stream, therefore remain cool, clean, and easily accessible. The new Wingfoil Fan has a remarkable "non-overloading" characteristic. Sizes 10" to 60"; capacities up to 85,000 CFM.



WINGFOIL DUCT FAN
(Straight Line Type)

Designed to form a part of any straight run of duct. The motor is mounted on an adjustable base outside of the housing. V-belt drive is through an air tube carried across the housing and supporting fan shaft and bearings. Fan wheel is the new non-overloading Wingfoil Fan. Bearings are grease-sealed, requiring minimum of attention.

Write For Bulletins



Heated Air in Motion Keeps Metals From "Sweating"

AN exclusive advantage of WING Revolving Unit Heaters applies to rooms and buildings in which metal products are stored. In the above photograph, taken in the Jones & Laughlin plant at Muncy, Pa., the Wing Revolving Heaters keep the warm air in circulation among the coils of wire stored in this building, reaching every remote corner and preventing the "sweating" that would otherwise cost thousands of dollars in corroded metal. Even if *you* haven't this problem in *your* plant, this exclusive feature of the Wing Revolving Discharge keeps employees comfortable for the same reason. Write for Bulletin No. HR-5.

L. J. Wing Mfg. Co.

140 Vreeland Mills Road
Linden, N. J.

Canadian Factory: Montreal

WING

Wing

Revolving UNIT HEATERS

These are the steps that save you money with

ULTRALITE

DUCT INSULATION and DUCT LINER

Try Ultralite just *once* — and you'll discover that it eliminates application difficulties that make other insulations cost more in the long run!

You'll like, too, Ultralite's superior thermal and acoustical properties, and its amazing physical characteristics. The long glass fibers are fire-resistant, non-corrosive, non-irritating, and as permanent as glass itself. Ultralite will not settle, shake loose, delaminate or disintegrate under air movement or vibration, nor will it pick up odors.

Ultralite is available plain, or with 6 different facings.

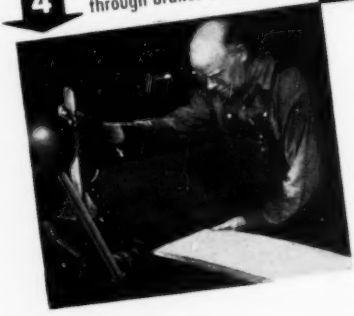
1 ULTRALITE comes in easy-to-handle rolls with a choice of widths and thicknesses. It can readily be cut with a knife.

2 ULTRALITE Duct Insulation and Liner can be firmly fastened in place with adhesive/metal screws and washers.

3 Eases the problems of fitting or going around curves and corners — you can wrap ducts as you would a package with ULTRALITE!

Now you can acoustically line ducts at the same time you form them! Simply adhere ULTRALITE to metal before running through brakes and shears.

4



For free samples and A.I.A. File #37-D-2 WRITE TODAY!

GUSTIN - BACON MFG. CO.

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NEW YORK · CHICAGO · PHILADELPHIA · SAN FRANCISCO
LOS ANGELES · HOUSTON · TULSA · FT. WORTH

Distributors Conveniently Located Throughout the U.S.

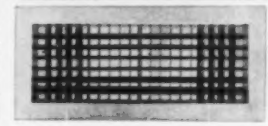
1ST IN AIR DISTRIBUTION PERFORMANCE...IN VALUE PER DOLLAR...

A COMPLETE LINE
THERE'S NO FINER GRILLE THAN AIRFOIL

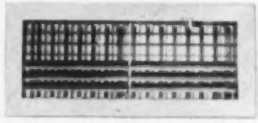
S-2 Featuring vertical front louvers and horizontal rear louvers.

L-2 Featuring horizontal front louvers and vertical rear louvers.

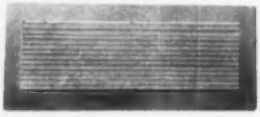
AirFoil
AIR CONDITIONING OUTLETS



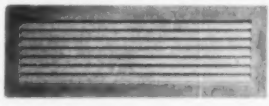
L-270 4-way directional grille for complete control of air stream.



L-274 Double directional grille with multi-shutter damper.

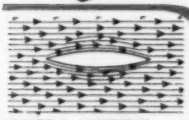


RL-21 Return air grille fixed deflection type.



RL-230 Return air grille extra rugged construction.

AG-25 Volume controller designed to fit behind grille.

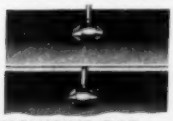


EXTRA WIDTH AIRFOIL LOUVER

Wide louver surface gives unequalled, directional control of air flow. Glass-smooth streamlining eliminates noise—turbulence. Solid section adds much strength.

EXTRA HEAVY RUBBER GASKET

Seals grille tightly to wall. Eliminates ugly dust streamers—cuts cleaning expense.



EXCLUSIVE PAT. CONCEALED CYL. SUPPORT . . . Allows grille to be made to meet special requirements of any size or shape. Eliminates mullions and ugly butted construction. Adjusts easier.

THESE PRIME FEATURES *GUARANTEE* PERFORMANCE UNOBTAINABLE WITH ANY OTHER GRILLE . . .

- **EXTRA WIDE BEVELED BORDER**
- **COUNTER SUNK SCREW HOLES**
- **SMOOTH—MITERED CORNERS**
- **UNIFORM LOUVER TENSION**
- **ATTRACTIVE EXTRA-DURABLE FINISH**

HIGH QUALITY—SAVES MONEY

Precision manufactured AIRFOIL GRILLES work *right* . . from the first. Eliminate costly replacement or adjustment "Call-Back". Adjust easy . . install easy. Assure lasting customer satisfaction.

STRONGER—YET EXTRA LIGHT

Workmen lift less weight. Contractors save costly TIME and LABOR. Solid AIRFOIL section adds strength. ONE-PIECE, super-strong frame cuts weight. Design is extra neat with eye-catching beauty.

FREE

Send for complete illustrated literature. Check box for special additional information.

- ☐ Air conditioning outlets
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- ☐ Perforated metal and ornamental grilles
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☐ Send literature on above checked items.

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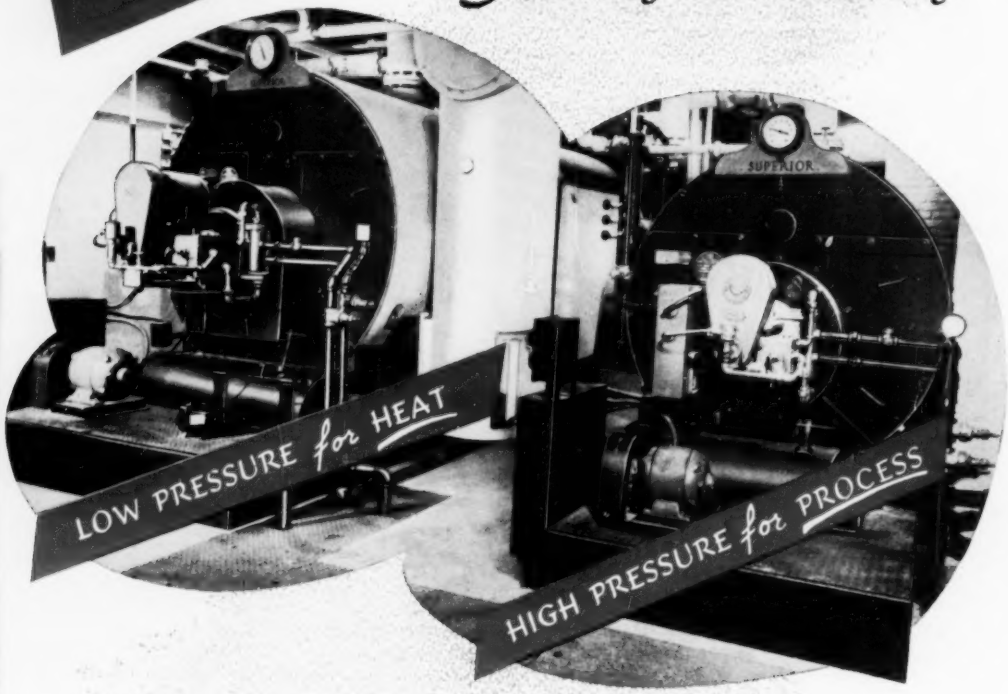
Superior
STEAM GENERATORS

at the
PHILADELPHIA
Textile Institute



In search of new techniques and lower operating costs (of which cost-of-steam is an important factor) the Philadelphia Textile Institute conducts constant research for the Textile Industry . . . and for their new Scholler Laboratories, where much of this research is carried out, Superior Steam Generators were chosen because of their recognized economy of operation and low cost steam production. The two units shown supply heat for the entire building and process steam for Scholler Laboratories, as well as for Althouse and Burlington Laboratories. If you use steam for heat or process, you'll want the details given in Superior Steam Generator Catalog 204

18 sizes from 20 to 600 bhp. • Fully automatic with any grade of oil, gas, or both. • More than 80% thermal efficiency guaranteed.

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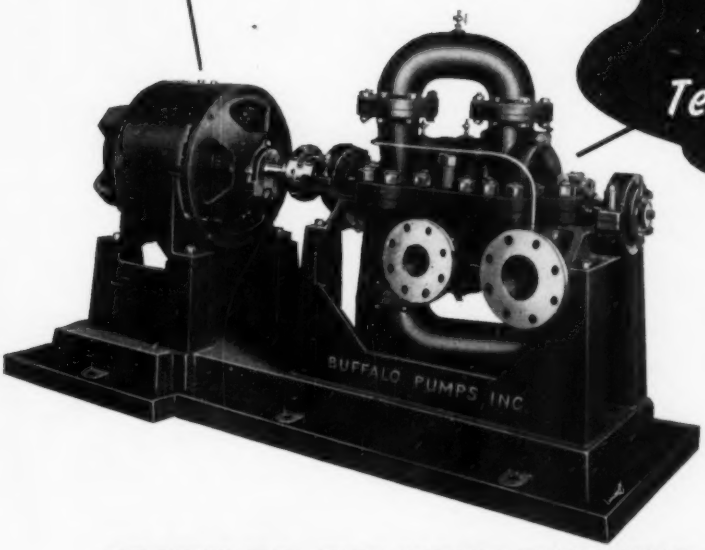
Factory: Emmaus, Pa.
Executive Offices: Times Tower, Times Square, New York 18, N. Y.

For Pressures up to 1500 Ft.

For Clear Water Service

Efficient at any Temperature



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"RR"
PUMPS

READY TO CUT YOUR PUMPING COSTS

If you have a clear-water pumping application calling for a high head and capacity between 20 to 900 gpm., you'll get satisfaction with an "RR". These "Buffalo" Single Suction Two and Four Stage Pumps have set both efficiency and endurance records on the job — in air conditioning, boiler feed and other general service. Thousands in use all over the country. WRITE FOR BULLETIN 980-B for the facts on these pumps users say you can "put in and forget".

—for handling clear water at high pressures, any temperature
"Buffalo"
Class "RR" Single Suction Multistage Pumps
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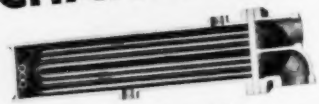
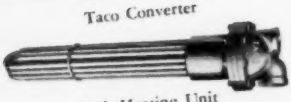
TACO'S NEW CATALOG HAS THE ANSWERS YOU NEED for...

HEAT EXCHANGERS... BIG or SMALL

Instant Taco



Taco Converter



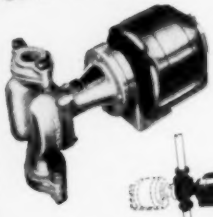
Taco Tank Heating Unit

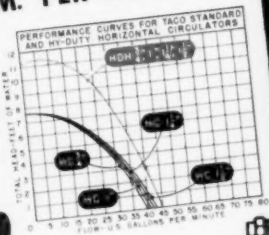
Instant Taco

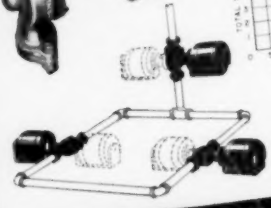
Tankless Steel Shell

ACCURATE DESIGN INFORMATION ON PANEL HEATING... floor, ceiling, snow removal

NEW HORIZONTAL CIRCULATORS PUMP MORE G.P.M. PER DOLLAR




PERFORMANCE CURVES FOR TACO STANDARD AND HY-DUTY HORIZONTAL CIRCULATORS
TOTAL HEAD FEET OF WATER
FLOW-U.S. GALLONS PER MINUTE



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Taco

TACO HEATERS, Incorporated

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NATIONAL Pipe gets first call for the United Nation's "Secretariat" Building

IN this 39-story skyscraper, the first structure in the permanent home of the United Nations, more than 400 tons of steel pipe were supplied by NATIONAL Tube Company. 178 tons went into the heating and air-conditioning systems, 208 tons were used in the plumbing lines, 23 tons serve as stair hand railings.

NATIONAL Pipe, produced by the world's largest maker of tubular products and used almost exclusively in this important building, is the same NATIONAL Pipe that has been giving uniformly good service for more than sixty years in all types of buildings throughout America. Constantly improved, thoroughly dependable, NATIONAL Pipe offers the most service per dollar of cost.

NATIONAL Pipe offers the user more for his money because there's more put into it. Its manufacture combines the finest steel making practice and the most advanced pipe making techniques. As a result, NATIONAL Steel Pipe is unsurpassed for its uniformity in all respects. Strong, clean, easy to thread and to weld, it installs readily, and performs so dependably that the passing years serve merely to demonstrate its superiority.

We welcome the opportunity to show you where and how NATIONAL Pipe can be used to improve your installations and to reduce their long-time cost.

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SHAFCONAIRE*

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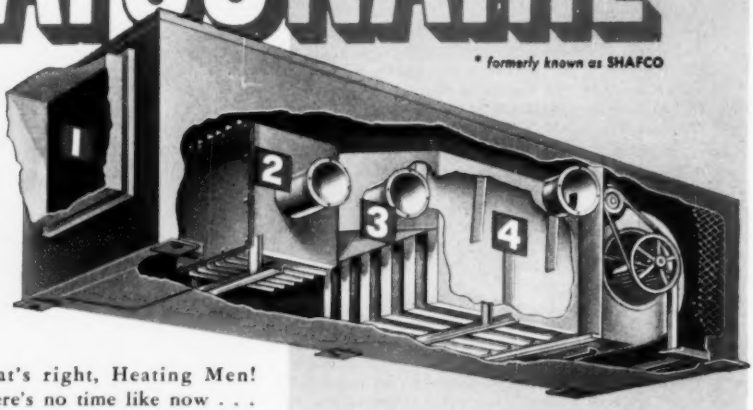

Leader in the Overhead Oil-Fired Heating Market

That's right, Heating Men! There's no time like now . . . *right now* to get set with SHAFCONAIRE OverHead Heaters. They're big business boosters, extra profit producers. For SHAFCONAIRE, you know, is the original suspended oil-fired furnace known for years as SHAFCO. It's quality-built from end to end . . . designed especially for use in commercial and industrial buildings. Not just a domestic floor-type unit tilted horizontally on its side. And SHAFCONAIRE has been time-tested, thoroughly proved in use . . . the only furnace of its type backed by over 12 years actual operation in the field.

MODELS from 100,000 to 405,000 B.T.U. for single or multiple unit installation to meet a wide range of commercial and industrial heating requirements.

OVERHEAD HEATERS, INC.

(formerly SHAFCO Distributing Corporation)

1354 BOOK BUILDING • DETROIT 26, MICHIGAN

And here's something to talk about

4 ESSENTIAL FEATURES FOUND ONLY IN SHAFCONAIRE

1. BUILT-IN PLENUM CHAMBER—An exclusive patented feature that saves you plenty of time, trouble, and guess-work in making installations. Assures uniformly heated warm air output, eliminates on-the-job sizing and extra sheet metal work. Just top off ducts from end, top or both sides to meet installation requirements.

2. HEAVY DUTY CONSTRUCTION—Use of heavy gauge welded boiler plate assures long-life, trouble-free operation. No warping, no buckling, no burn-outs common to stamped steel construction.

3. INTERMEDIATE HEAT-TRAVEL SECTION—Patented intermediate chamber between refractory-lined firebox and heavy gauge heat exchangers serves to spread flame and eliminate impingement on metal. Permits expansion of hot gases, improves operating efficiency.

4. EFFICIENCY ENGINEERED HEAT EXCHANGER—Alternately spaced baffle plates in each of the heat exchanger sections effectively retard the flow of hot gases toward stack connection, permit maximum transfer of heat.

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Please send me complete information and Price Lists on SHAFCONAIRE (formerly SHAFCO) OverHead Heaters.

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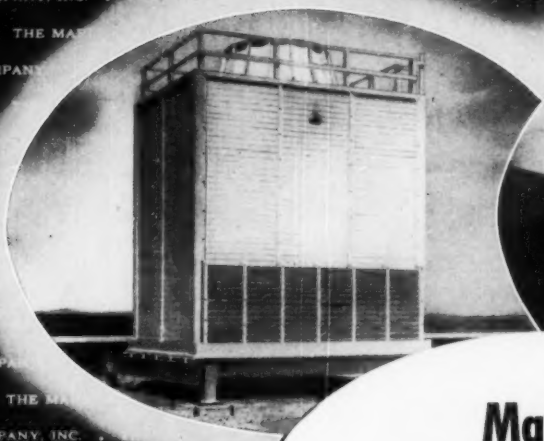
DON'T DELAY!
SEND COUPON TODAY!

You'll get complete details and price information on the "hottest" bet for extra profits in the present heating market.



Marley Conventional Cooling Towers

"They Have Guts"

DON'T judge a cooling tower by its *outside* appearance . . . it's the *inside* that really counts.

You can't expect to get the same amount of cooling from filling slats placed in a few decks twelve inches or more apart as in a tower with filling decks spaced 4 to 6 inches apart. Water break-up from a few big nozzles or flumes is not as fine and as uniform as the water pattern developed with many small nozzles. Air-water contact cannot be made by inefficient fans.

And, don't forget to look for "long life" factors such as mechanical equipment designed for and used only on cooling equipment. Nail-less filling that is free to expand and contract . . . (filling that doesn't depend on the nails failing to corrode to keep its pattern.) Heavy diagonal bracing that withstands the elements. Ring connectors in critical wood joints. All joints in metal towers double bolted. Heart quality redwood and metal of a heavy gauge to give years of wear.

The towers illustrated are "brothers under the skin." Both are Marley Conventional heavy duty cooling towers — both have long-life and dependability built into every part. Both are available in redwood or steel. Both redwood and steel towers are available with asbestos-board covering.

On any method of evaluation which includes first cost, maintenance cost, operation cost, amortization and dependability, a Marley Conventional tower is the most economical counter-flow cooling equipment. Let a Marley application engineer help you with your water cooling problem at no cost or obligation. Bulletin C-50.

MAIL THIS COUPON TODAY

The Marley Company, Inc., Kansas City 15, Kansas

☐ What's Your Cooling Tower I.Q.? Illustrated folders available on operation, maintenance, water treatment, testing, specification, etc. No charge, of course.

☐ Have Marley salesman call.

HP-9

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Company Name _____

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MARLEY

Double-Flow

Vairflo

DriCooler

Natural Draft

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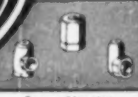
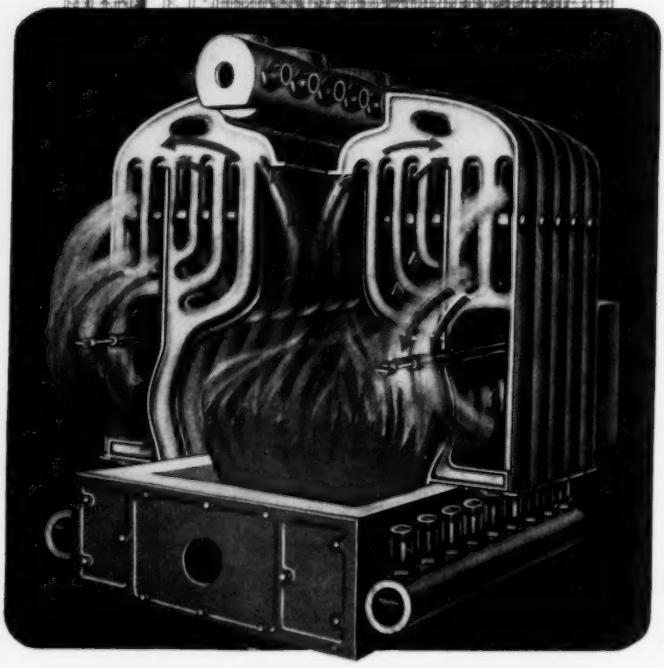
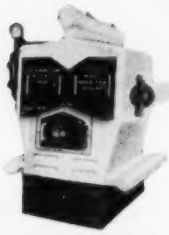


Spray Nozzles

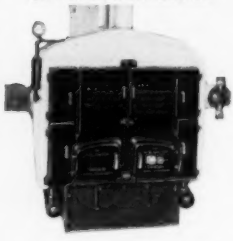
IT'S SOMETHING LIKE A ROLLER COASTER





No. 240 SMITH-MILLS Water Tube Boiler in 6 sizes for steam, 6 for hot water; 900 to 2025 square ft. net steam radiation.

No. 340 SMITH-MILLS Water Tube Boiler in 9 sizes for steam, 9 for hot water; 2000 to 5200 square ft. net steam radiation.



No. 440 SMITH-MILLS Water Tube Boiler in 14 sizes for steam, 14 for hot water; 3600 to 4400 square ft. net steam radiation.

. . . the way the hot gases travel in a Smith Mills Cast Iron Boiler means economy and satisfied customers for you

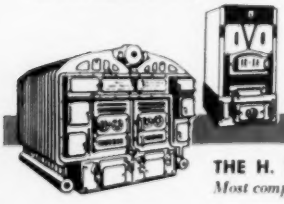
. . . whipped up and around the entire chamber they go directly to the highest surface of the boiler — then across to each side — to the front through the upper flue passages — to the back through the lower channels . . . finally, spent and exhausted, they pass up the chimney.

In the efficient Mills design the hot gases embrace a cast iron boiler water tube at every "roller coaster" turn. These gas passages are relatively large — the gases travel at low velocity, transferring maximum heat to the tubes, allowing ample time for complete combustion. There is less draft loss — and less need for high chimneys — with a Smith-Mills Boiler.

Results? More heat with less fuel, lower maintenance — and often lower installation costs.

It pays to specify Smith-Mills Boilers for all heating needs in industrial, commercial, institutional and residential jobs. For these and other advantages send for free bulletins today

We can often help you close the deal with convincing case histories of Smith-Mills Cast Iron Boilers that have been *saving money* for schools, hospitals, stores, factories, hotels, libraries . . . and private homes. Let us help you.



H. B. Smith

2-B

CAST IRON BOILERS

THE H. B. SMITH CO. INC., WESTFIELD, MASS.

Most complete line in the world of cast iron boilers for heating

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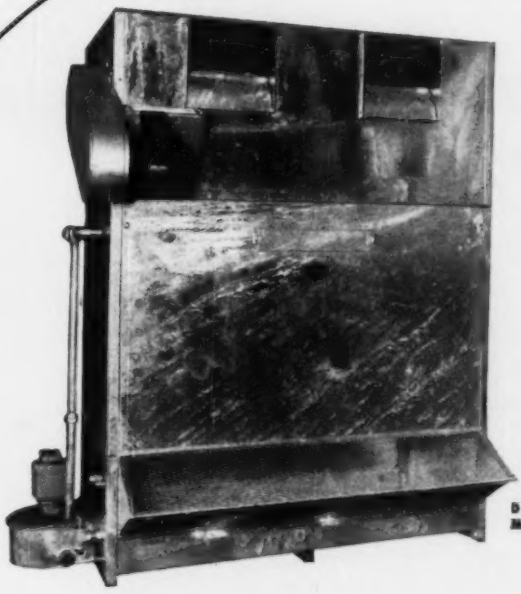


DOUBLE-FAN MODEL

*Acme EVAPORATIVE CONDENSERS

Now, for further protection against corrosion, all steel parts including wheels and scrolls on Acme Evaporative Condensers are completely *Hot-Dip Galvanized* after fabrication—and at no increase in price. Units are assembled using stainless steel nuts, bolts and screws.

Designed for unusually large water savings, outstanding performance and long life—there's a size and model Acme Evaporative Condenser for practically every Freon or Ammonia application. Write for Catalog No. 527 for further details.

ACME PRODUCTS

ACME INDUSTRIES, INCORPORATED

OUR 30TH ANNIVERSARY OF CONTINUOUS SERVICE TO THE REFRIGERATION INDUSTRY

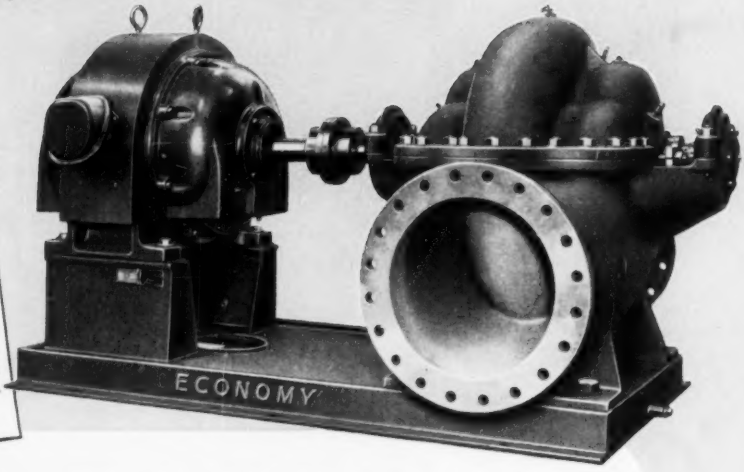
JACKSON, MICHIGAN

Representatives in Principal Cities

A DAY'S WORK FOR "OLD FAITHFUL"

...but just a 9 minute job for this ECONOMY PUMP

Erupting every 65.6 minutes, Old Faithful spouts a quarter-million gallons per day in an impressive display of Nature's "pumping" power. The same volume of water can be delivered in less than 9 minutes by an ECONOMY Double Suction Pump.



From 50 to 30,000 gallons per minute, there are more than 1500 models of this Economy Double Suction Pump . . . to meet your requirements for any capacity at heads to 300 feet. Designed for general purpose pumping of clear liquids at moderate heads, these single stage units are suited to general water supply or heavy mill service.

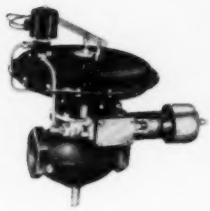
Sound hydraulic design give these Economy Pumps a broad, flat efficiency curve over a wide capacity range. Minimum maintenance is assured by sound engineering—based on such advantages as:

- **Easy removal of complete rotor without exposing bearings.**
- **No leakage between sleeve and shaft . . . shaft sleeves are sealed.**
- **Flanged wearing rings, "L" shaped, inward flow.**
- **Unusually effective water seals.**
- **Large wells for lubrication.**

If you wish full details, our Dept. C-9, will gladly send you Catalog A-1147.

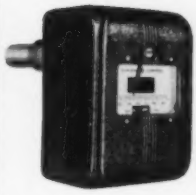
Economy Pumps Inc.

DIVISION OF HAMILTON-THOMAS CORP., HAMILTON, OHIO



B-55 G Governor Type Valve

T-70 and T-70T Thermostats



L-32 Immersion Thermostat

SB Interval, On-Off Time Switch

for better HEAT CONTROL check GENERAL CONTROLS

Whatever the control problem . . . whether it's product control . . . or process control . . . in any application where a higher level of operating performance is the goal . . . automatic controls more often than not form the solution . . . and in the field of automatic controls . . . there's certain to be a General Control that can be relied upon to do a better job. That's why more and more of the leaders in American Industry are joining in the big swing to General Controls . . . that's why there are so many new voices in the rising chant that,

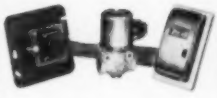
"for the best in automatic control, it's General Controls."

A-100 Thermopilot Relay

R-99 Stack Switch

L-54 Solid Charge Combination Fan and Limit Control

Hydrometer G 1-7



T-30 Package Set

BX-69 Package Set

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801 Allen Avenue Glendale 1, California

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls

FACTORY BRANCHES: Baltimore 5, Birmingham 3, Boston 16, Buffalo 3, Chicago 5, Cincinnati 2, Cleveland 15, Dallas 1, Denver 4, Detroit 21, Glendale 1, Houston 6, Kansas City 2, Minneapolis 2, Newark 6, New York 17, Philadelphia 23, Pittsburgh 22, St. Louis 12, San Francisco 7, Seattle 1, Tulsa 6. DISTRIBUTORS IN PRINCIPAL CITIES

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PRECISION ENGINEERED—positive closure . . . minimum friction . . . designed for smooth, free flow of air, gases and liquids.

PRECISION BUILT—every essential part accurately finished for a precise fit, on the most modern production equipment.

PRECISION APPLIED—OIC engineers always available to help you select valves best suited to each job, at lowest cost.

Here's a three-way combination that provides *"precision valve" equipment* in your plant. First costs and upkeep costs are lower. See your local OIC distributor, or write us direct. Ask for a free copy of the 1950 OIC Valve Cross-Reference Chart. The Ohio Injector Company, Wadsworth, Ohio.

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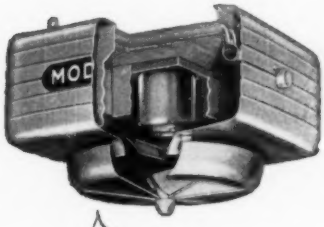
It pays to call your shots when selecting Unit Heaters

AIM FOR STYLING

There's a new kind of functional beauty in Modines—styled by one of America's top industrial designers. Comparison with any other unit heater proves Modine miles ahead in eye-appealing design.



AIM FOR CONSTRUCTION

Any owner will tell you how well Modines stand up. There's a reason. Exclusive use of copper and copper alloy for condenser provides maximum resistance to corrosion. Fins and tubes are permanently metal-bonded and all joints are brazed. Tube expansion bends absorb differential stresses. Parker-Bonderizing protects steel casings from rust.

AIM FOR PERFORMANCE

Finest performance with any model—*Horizontal*, *Vertical*, or *Power Throw*. Because they're engineered *right*—Modine Unit Heaters give you the *right* combination of correct outlet temperature and sufficient air velocity for uniform comfort . . . maximum economy.

You'll smack the bull's-eye every time when you select Modine

YES, *call your shots* when selecting unit heaters! Your choice will be Modine. Wherever they're installed—in factories, stores, hundreds of other locations—Modine Unit Heaters stand out in service. Get all the facts from your nearest Modine representative. He's listed in the classified section of your phone book. Or write direct. Modine Mfg. Co., 1509 Dekoven Ave., Racine, Wis.

Ask for Modine Unit Heater Bulletin 149A. It contains complete data on all Modine Unit Heaters. Also available—bulletins covering special applications in commercial brooder houses, greenhouses and milk houses.

Modine UNIT HEATERS

U-1067

FOR FACTORIES • GREENHOUSES • STORES • COMMERCIAL BROODER HOUSES • MANY OTHER APPLICATIONS

What's Your "GUESS-TIMATE"

OF THE UNIT COST OF THE HEATING SYSTEM FOR THIS SCHOOL

6½ UNIT SCHOOL
Elderton, Pennsylvania

MY GUESS IS:

$_____PER UNIT

NOTE YOUR ESTIMATE HERE
THEN SEE HOW CLOSE YOU CAME!

High heating costs took a real body blow in this Western Pennsylvania supplementary high school, completed in 1949.

Usual heating costs for the conventional wet-type system generally run around $1500 per unit. By using an efficient warm air system with a Dravo *Counterflo* Heater, ventilating requirement of 15 cu. ft. of fresh air per pupil per minute was met, adequate warmth was assured, and the cost was cut to $860 per unit!

This remarkable saving was possible because the Dravo Counterflo Warm Air Heater reduces the job to its simplest basic terms. Where most systems *end up* by warming the air, this system BEGINS with it, eliminating time-lag, and thus permitting quick heat-up in the morning, and immediate adaptation to changes in mid-day demand. Winter heating and year-round ventilation functions are efficiently combined. The valves, traps, extensive piping, etc., of conventional wet-type systems are eliminated. Dependability and effectiveness are certified by the thousands of industrial and commercial applications where Dravo Heaters are currently serving.

This installation conforms in all respects to Pennsylvania Department of Public Instruction regulations. The architects were Scheeren & Rittenhouse, Kittanning, Pa.

The Dravo *Counterflo* Heater, with an output of 1,000,000 btu, was specified over-capacity, to take care of future expansion of the building. The heater is located in an 8-ft. x 12-ft. furnace room. Recirculated air is blended with air drawn from outside, and delivered through ducts, concealed in the hall ceiling to the various rooms. Gas is used for fuel; ready conversion to oil is possible.

DRAVO CORPORATION

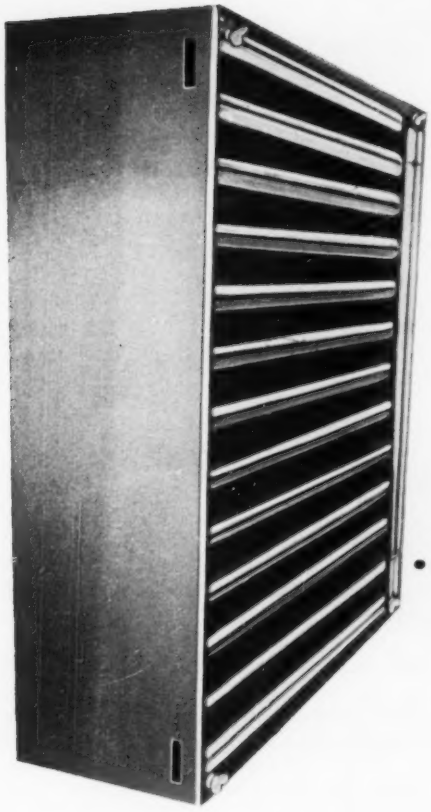
Almost everyone concerned with school construction has budget problems today. The Dravo *Counterflo* Heater provides a proved means of substantially reducing the item of heating cost — and at the same time meeting every comfort, safety and low-maintenance requirement. A case study analysis, which describes the Elderton school in detail, will be sent on request. Write Dravo Corporation, Heating Department, Dravo Building, Pittsburgh 22, Pennsylvania. Ask for Bulletin 560-38-468.

Dravo also manufactures the *DRAVO CRANE CAB COOLER* for air conditioning hot-metal crane cabs.

PITTSBURGH • CLEVELAND • PHILADELPHIA • DETROIT • NEW YORK • CHICAGO • ATLANTA • BOSTON

Sales Representatives in Principal Cities. Mfd. and Sold in Canada by Marine Industries, Ltd., Sorel, Quebec

Export Associates: Lynch, Wilde & Co., Washington 9, D. C.



We sell "C" cells

...that materially reduce the cost of air conditioning

The picture shows a Dorex Type C Air Recovery Cell. In an air conditioning system or unit, it purifies the air, improves ventilation, saves cooling and heating costs by reducing necessary intake of new, outside air as much as two-thirds.

Notice the "accordion pleats." They contain Dorex *Activated* Carbon. As used air flows through the "C" Cell, this special carbon extracts and retains all odorous, vaporous and gaseous impurities—just as a gas mask would. Stale air is purified, made fresh and completely reusable.

A double saving results from the use of Dorex Type C Air Recovery Cells. (1) Initial air conditioning equipment costs are less because, obviously, less heating and cooling capacity will be required. (2) Operating costs come down—because it costs only about half as much to freshen used air as to condition new air.

Dorex Air Recovery has proved its effectiveness in more than 6,000 installations over the past 20 years. If you do not have complete information in your files on how Dorex works, who uses it, and its great advantages to you and your clients—let us send it to you. Just mail the coupon below.

DOREX
Air Recovery

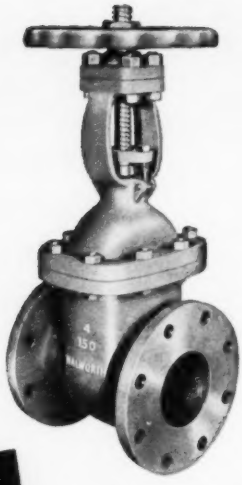
W. B. CONNOR ENGINEERING CORP.
114 East 32nd Street, New York 16, N. Y.
Air Diffusion • Air Purification • Air Recovery
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

W. B. CONNOR ENGINEERING CORP.
Dept. A-90, 114 East 32nd Street, New York 16, N. Y.

Please send me, without obligation, full information on Dorex Air Recovery.

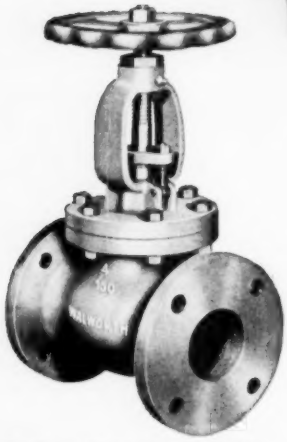
Name .....
Position .....
Company .....
Street .....
City ..... **Zone** ..... **State** .....

Newly Designed Walworth Valves to combat corrosion



Walworth 150-pound Stainless Steel Gate Valve . . . available in sizes ½ to 3-inch, screwed; ½ to 12-inch, flanged.

Made of Stainless Steel
Monel · Nickel
Acid-resisting Bronze
Ni-resist



Walworth 150-pound Stainless Steel Globe Valve . . . available in sizes ½ to 3-inch, screwed; ½ to 6-inch, flanged.

— ENGINEERED AND TESTED FOR TOUGH . . . HARD SERVICE

Walworth offers a comprehensive line of valves made of several cast stainless steels and special alloys for piping services where corrosion is a factor. These valves are available in Gate, Globe, Angle, Check, and Lubricated Plug types.

Gate, Globe and Angle Valves have outside screw and yoke construction, thus keeping the stem threads out of contact with the corrosive material in the line. They also have a two-piece bolted gland with ball-type gland follower to prevent binding the stem when packing bolts are tightened. Gland eye-bolts can be conveniently swung out of the way without danger of loss when the gland is lifted for repacking.

Gate Valves have taper seats with a unit consisting of two flat faced discs supported by a carrier on the end of the stem. The discs are of a proven ball-and-socket type. They are free to rotate and adjust themselves to the body seat angles, assuring tight seating with no possibility of sticking in any position.

For further information about Walworth's full line of corrosion-resistant valves, see your Walworth distributor.

Sectional view of Walworth 300-pound Stainless Steel Gate Valve . . . available in sizes 2 to 6-inch, flanged.

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Handy guide for low-cost heat

CARRIER 46U HORIZONTAL DISCHARGE UNIT HEATER

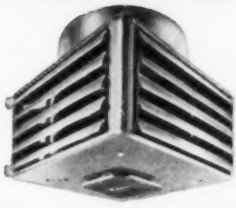
RECOMMENDED for garages, factories and other industrial spaces as well as beauty shops, exclusive stores and quality buildings.

FOR USE with steam or hot water.

ADVANTAGES: Combines attractive appearance with quiet operation and sturdiness that assures long life. New single-row coil construction offers less air resistance and facilitates cleaning.

CAPACITIES range from 13,400 to 200,000 Btu's per hour.

CARRIER 46S FOUR-WAY DIRECTED-FLO UNIT HEATER



RECOMMENDED for buildings best served by quick heat from relatively high ceiling suspension.

FOR USE with steam or hot water.

ADVANTAGES: Air discharges from 1, 2, 3 or 4 sides provide maximum flexibility in air distribution. Heat can be directed in any quantity and at any angle.

CAPACITIES range from 49,000 to 500,000 Btu's per hour.

CARRIER 46T GAS-FIRED UNIT HEATER

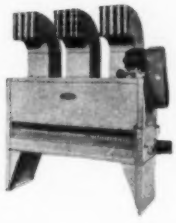
RECOMMENDED for clean, economical heat in offices, factories, warehouses and other types of buildings where gas is available.

FOR USE with gas.

ADVANTAGES: Heat exchanger *and* combustion chamber of Aluminized Steel are welded into one leakproof assembly for long, trouble-free life. Requires no pipes, ducts, boilers.

CAPACITIES range from 70,000 to 230,000 Btu's per hour input.

CARRIER 46PQR HEAT DIFFUSER



RECOMMENDED for ventilating as well as heating large enclosed spaces in factories, warehouses, hangars, garages and similar buildings.

FOR USE with steam or hot water.

ADVANTAGES: Multiple discharge outlets with adjustable louvres permit air to be delivered in practically any direction. Sectionalized for easy handling, lower erection costs and convenience in installing. Floor, wall or ceiling mounted—right or left assembly.

CAPACITIES range from 115,000 to 1,570,000 Btu's per hour.

Pick the Carrier Unit Heater that's right for the job and you're assured maximum efficiency at minimum fuel cost. Every Carrier Unit is field-tested for superior performance, and engineered and constructed for years of service. Whatever its style, size or type, you get plus values when you install a Carrier Unit Heater. Carrier Corporation, Syracuse, New York.

Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

For speedier shopwork . . .
Jobs like this are a natural for . . .
U·S·S Galvanized Sheets

STEEL SHEETS with good forming characteristics contribute to the efficient, profitable operation of your shop. They result in better jobs . . . enable you to turn out more of them . . . in short time . . . with less waste.

Closely controlled in size, weight, ductility, flatness and finish, U·S·S Galvanized Steel Sheets give you true bends, tight seams and neat joints even in forming difficult shapes.

But workability is not the only reason for using U·S·S Galvanized Steel Sheets. Your customers know that the familiar U·S·S trade-mark stands for the highest quality. Thus, jobs done with these superior sheets are easier to sell . . . assure customer satisfaction.

To stand up under severe atmospheric conditions

U·S·S GALVANIZED COPPER STEEL SHEETS

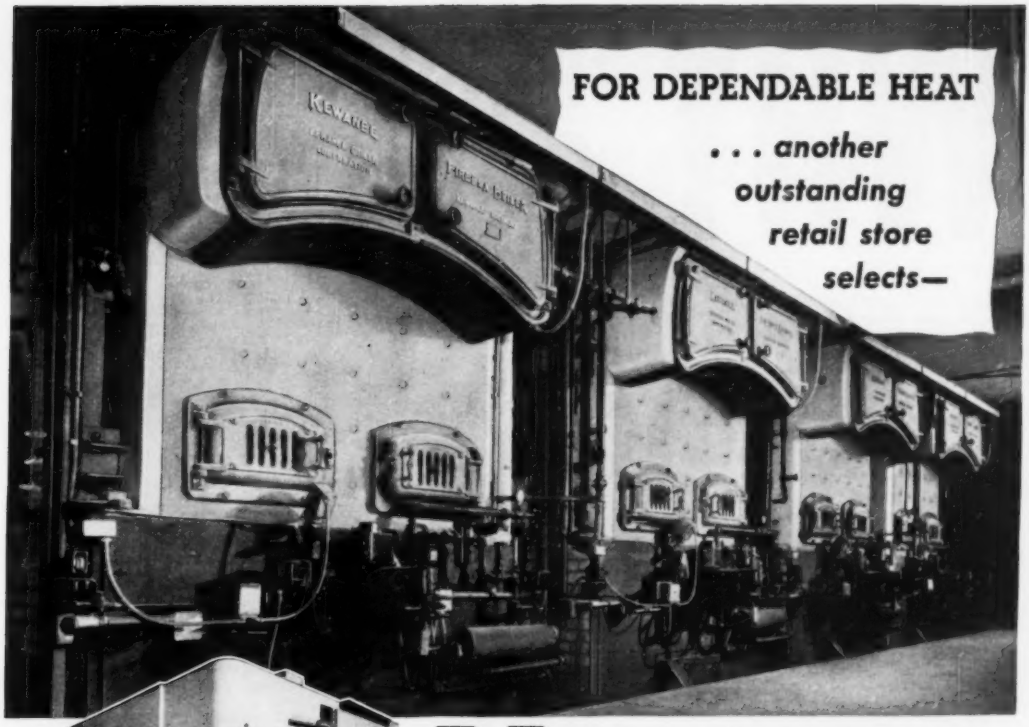
— give twice the atmospheric corrosion resistance at little additional cost!

CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH · COLUMBIA STEEL COMPANY, SAN FRANCISCO · TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST TO COAST · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS TRADE MARK

GALVANIZED STEEL SHEETS

UNITED STATES STEEL

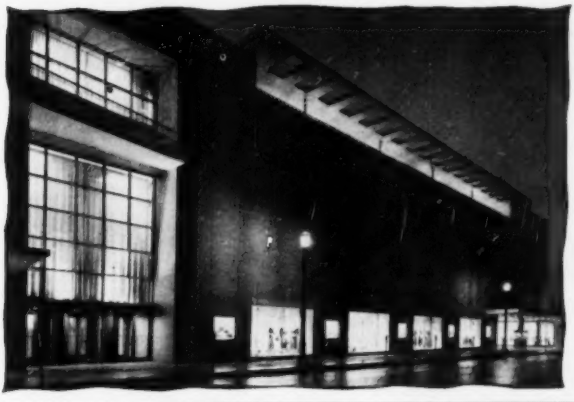


FOR DEPENDABLE HEAT

. . . another outstanding retail store selects—

WIEBOLDT'S DEPARTMENT STORE, Evanston, Illinois
Holabird & Root & Burgee, Architects and Engineers
Northwestern Heating and Plumbing Co.,
Heating Contractors

KEWANEE
STEEL BOILERS



Pictured above is the boiler room of the new Wieboldt's Department Store in Evanston, Illinois, which is equipped with four oil burning KEWANEE Steel Boilers producing 23,320,000 Btu hourly and having a total heating capacity of 97,160 sq. ft. steam.

Today's new, higher standards of comfort demand more efficient heating systems; just as advanced ideas in convenience to customers have resulted in new designs and planning for modern department stores.

This outstanding building is typical of the finer modern business structures which have chosen Kewanee Boilers for dependable, economical heat.

KEWANEE BOILER CORPORATION

BOILERMAKERS 80 YEARS KEWANEE, ILLINOIS
Branches in 60 Cities—Eastern District Office: 40 West 40th Street, New York City 18
Division of American Radiator & Standard Sanitary Corporation

Serving home and industry

AMERICAN STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

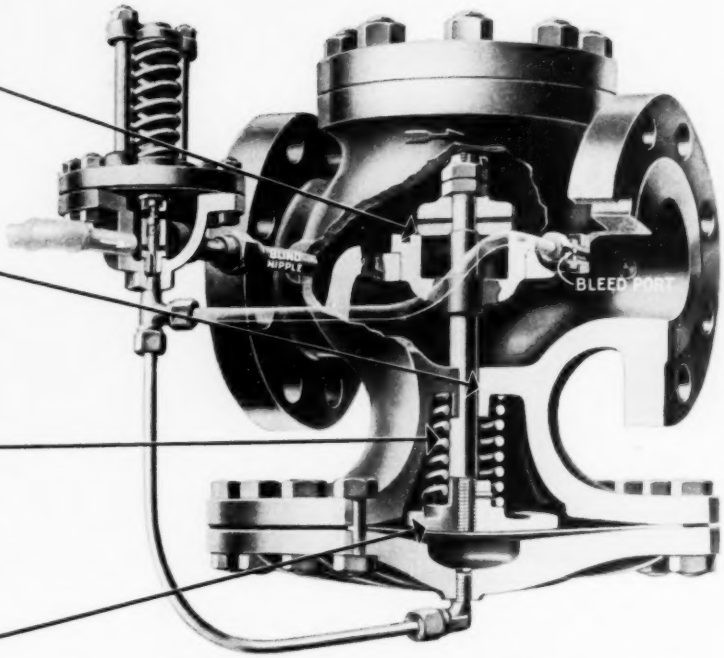
WHY Spence Regulators Outlast The Field

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than *twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.



Spence Type EQ back pressure regulator-operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

DURABILITY — Spence Regulators perform dependably year after year.

ACCURACY — You can be sure of accurate control for the life of the regulator.

MAINTENANCE — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

SR-110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

What's Your HEATING PROBLEM?

Young "SH" Unit Heater

COLD SPOTS?

A favorite for general space heating and eliminating "cold spots" in large areas is the Young Type "SH" horizontal discharge unit heater. These non-ferrous-core units deliver maximum heat transfer . . . use quiet and efficient fans. Available in 14 sizes, with capacities ranging from 19,000 to 325,000 Btu per hour.

Young "Vertiflow" Unit Heater

EXTRA HIGH CEILINGS?

Patented "Vertiflow" design offers a rugged, compact, highly efficient unit with low hp requirement. Its exclusive motor "ventilation" feature eliminates burn-outs from core heat. Seven sizes range from 52,600 to 552,000 Btu per hour, and cover larger areas quicker, with fewer units. Diffusers, nozzles, and Anemostats provide any heat pattern desired.

Young Cabinet Unit Heater

DRAFTY AREAS?

Here's the ideal heating unit for lobbies, vestibules, auditoriums, etc. . . . wherever concentrated heating capacities are required and a compact, attractive exterior design is necessary. They are available in 3 sizes of each of 3 styles offering heating capacities ranging from 26,200 to 115,000 Btu per hour.

YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Young Quality

Reg. U. S. Pat. Off.

Heating, Cooling, Air Conditioning Products for Home and Industry.

YOUNG RADIATOR COMPANY

Dept. 510-J, RACINE, WISCONSIN

Plants at Racine, Wisconsin and Mattoon, Illinois
Sales and Engineering Representatives in All Principal Cities

THIS COUPON BRINGS FULL DETAILS ON THREE SOLUTIONS TO HEATING DIFFICULTIES

YOUNG RADIATOR CO.
DEPT. 510-J.
RACINE, WIS.

Rush me information on the following Young Unit Heaters:

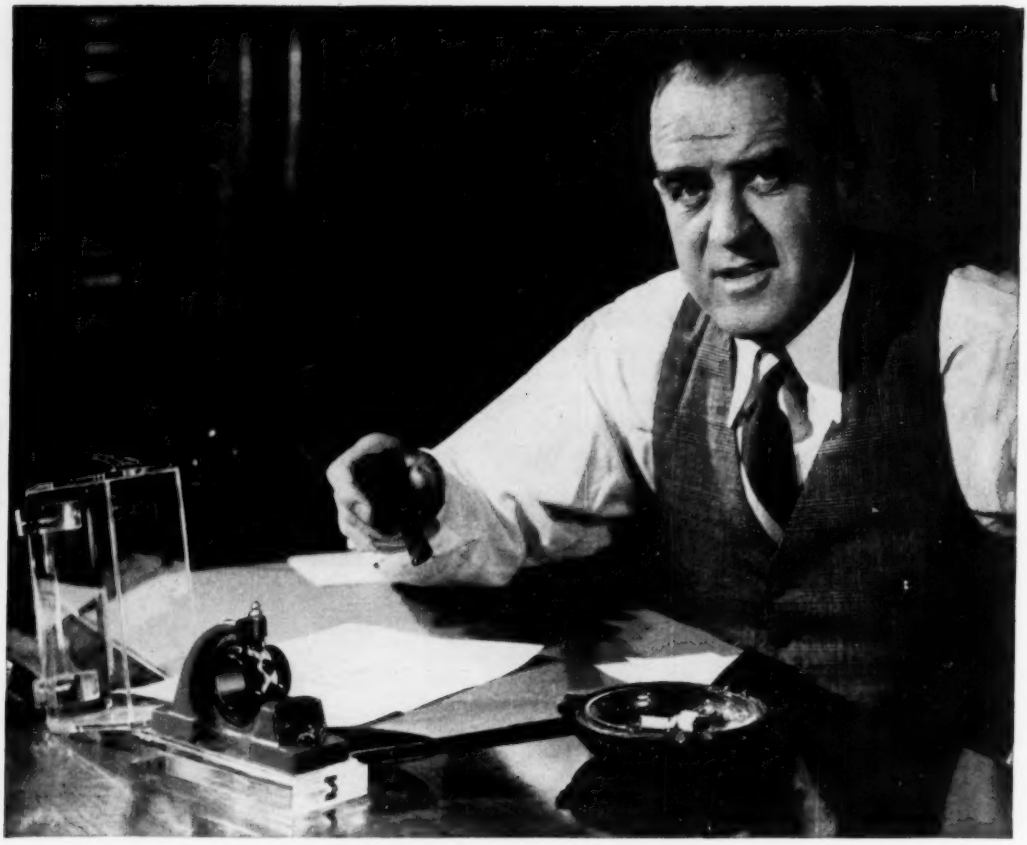
☐ "SH" ☐ "Vertiflow" ☐ Cabinet

Name_____

Company_____

Address_____

City_____ Zone____ State_____



"I got a new idea of bearing performance from SEALMASTER BALL BEARING UNITS"

Everybody using bearings has some idea of what he calls "good performance." It is suggested you match *your* idea with what a SealMaster Bearing Specialist can lay before you on the performance of SealMaster Ball Bearing Units. He will put on your desk a typical pillow-block unit cut-away, as shown above. You will see just *how* the combination of design features, unduplicated in any other bearing, accounts for the many case studies of improved performance.

We believe you will get a new idea of performance from such an interview. Write us and we will send a SealMaster Bearing Specialist. Ask also for Catalog 845 covering the full SealMaster Line of Pillow Blocks, Cartridge, Flange, Flange-Cartridge, Take-up and Hanger Units.

Bearing Division
STEPHEN S-A DAMSON MFG. CO.
47 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. · Belleville, Ontario

5 Reasons Why You're Better Off with SEALMASTERS

1. **Permanently Sealed!** Felt-lined steel flinger rotating in labyrinth, prevents entry of dirt and retains proper amount of lubricant.
2. **Self-Aligning!** Bearing Unit, with seals independent of the housing, can align itself in any direction without seal distortion.
3. **Prelubricated!** The bearing chamber is filled with the proper amount of grease before bearing leaves factory.
4. **No Housing Wear!** Patented locking pin and dimple prevent rotation of outer race in housing, thus eliminating housing wear . . . permit shaft alignment and position unit for relubrication.
5. **Floating Retainer!** Ball retainer is designed to float on ground inner surface of outer race . . . traps lubricant and prevents churning.

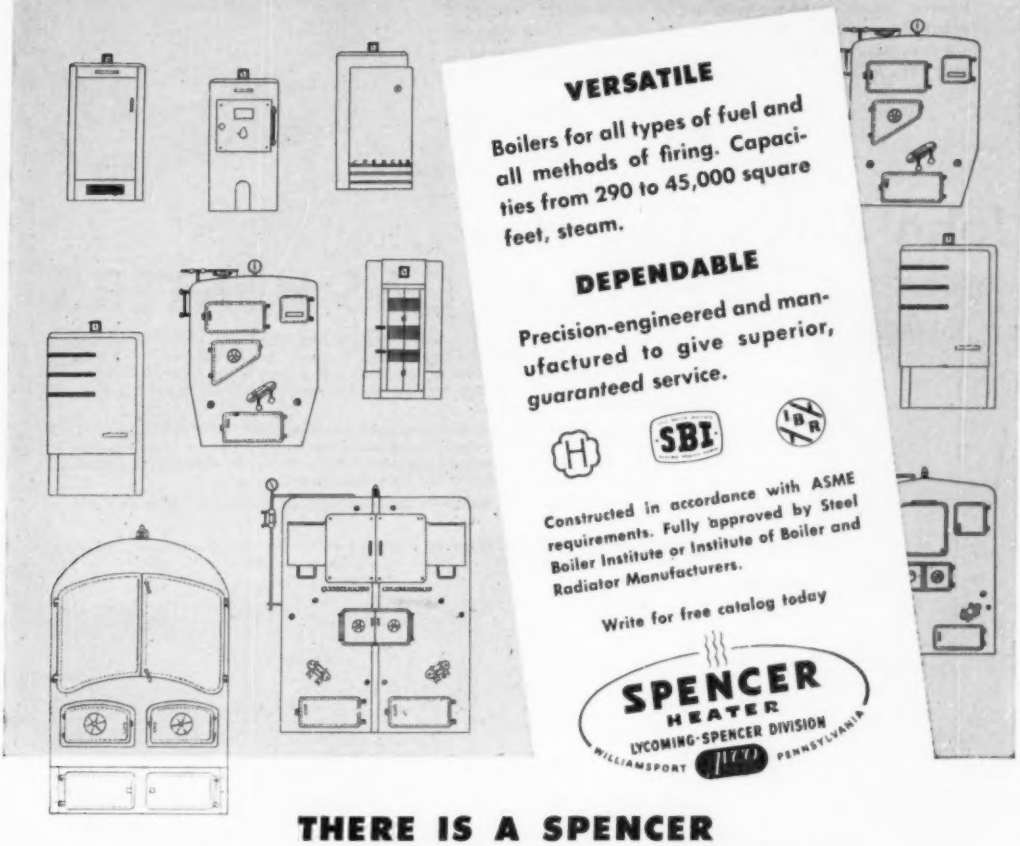
Invite the SEALMASTER engineer to show you why SEALMASTER'S exclusive combination of features gives you better bearing performance.

FACTORY REPRESENTATIVES AND DEALERS IN ALL PRINCIPAL CITIES

SPENCER

THE QUALITY LINE OF HEATING BOILERS

backed by more than 60 years' leadership



VERSATILE

Boilers for all types of fuel and all methods of firing. Capacities from 290 to 45,000 square feet, steam.

DEPENDABLE

Precision-engineered and manufactured to give superior, guaranteed service.

H SBI I B R

Constructed in accordance with ASME requirements. Fully approved by Steel Boiler Institute or Institute of Boiler and Radiator Manufacturers.

Write for free catalog today

SPENCER HEATER
LYCOMING-SPENCER DIVISION
WILLIAMSPORT PENNSYLVANIA

THERE IS A SPENCER
for every building . . . for every fuel

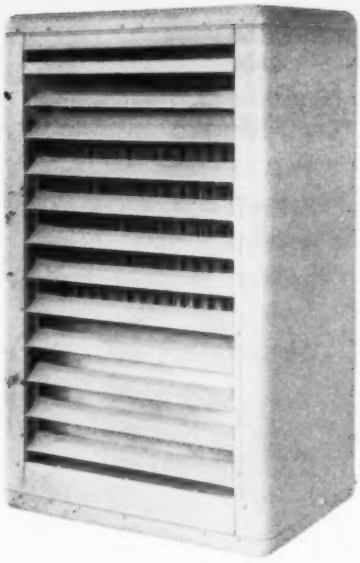
Including 34 Steel Heating Boilers for Commercial Installations

SPENCER

John Zink's New
SUSPENDED UNIT HEATER

(Series UHS Fan Type)

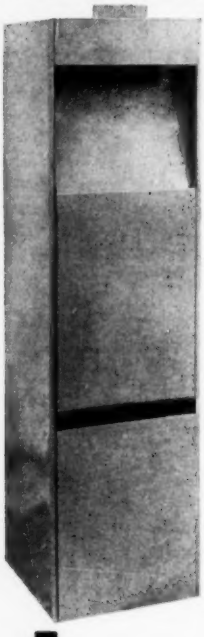
A.G.A. Approved for Natural, Mixed, Manufactured or LP Gas



For clean, safe, trouble-free heating of industrial and commercial establishments, gas-fired suspended heaters have proven themselves and the New John Zink UHS Gas-fired Suspended Heaters assure customer satisfaction. A complete, packaged unit fully automatic, the heaters are suspended from the ceiling to conserve valuable floor space and yet are designed so that they will be an attractive addition to any shop or store.

●

John Zink's Two New...
CENTRAL GAS HEATERS



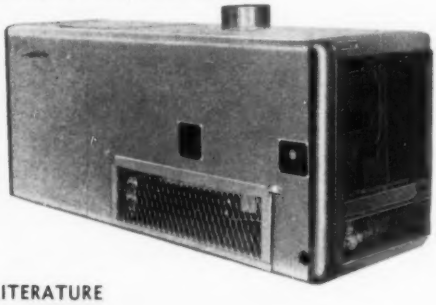
Type 80
Upright

Here is truly a universal, efficient, simple, and compact CENTRAL HEATING UNIT. Fully automatic, it is a complete packaged unit ready for installation. The two heaters shown are almost identical in operation and design of the heat exchanger. The two different types of casings are furnished to meet requirements for a particular application.

Heaters may be installed in the basement, attic, service closet, or utility room of a home. The AF-110 may be installed even under the house if certain provisions are made for the draft diverter. For industrial applications, it may be installed on a shelf or balcony; as a suspended heater and as a duct heater.

Each John Zink Central Gas Heater is equipped with an automatic safety shut-off that is really automatic.

The John Zink Central Gas Heater is designed as a winter air conditioner with a summer switch to provide air circulation during warm weather.



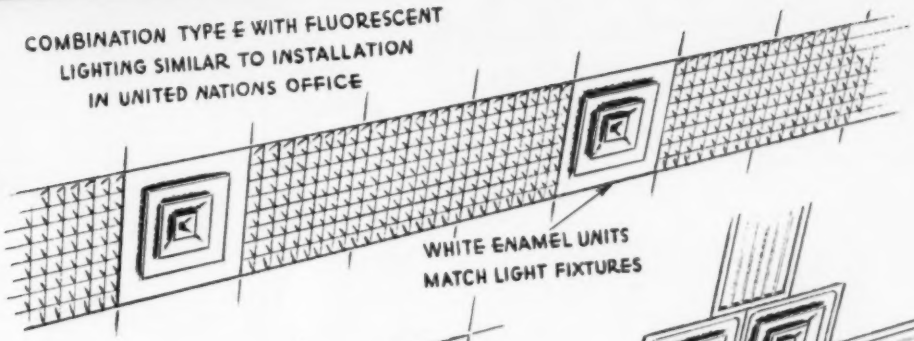
Horizontal
Type

WRITE FOR LITERATURE

JOHN ZINK COMPANY

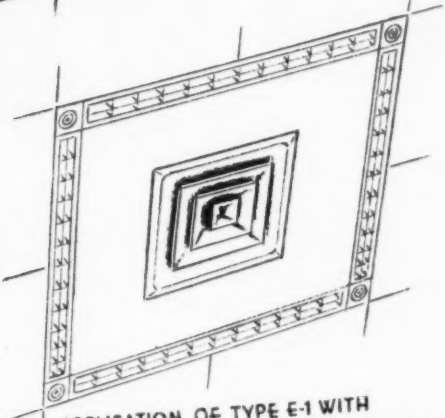
4401 SOUTH PEORIA — TULSA, OKLAHOMA

ideas *for using* ANEMOSTAT AIR DIFFUSERS

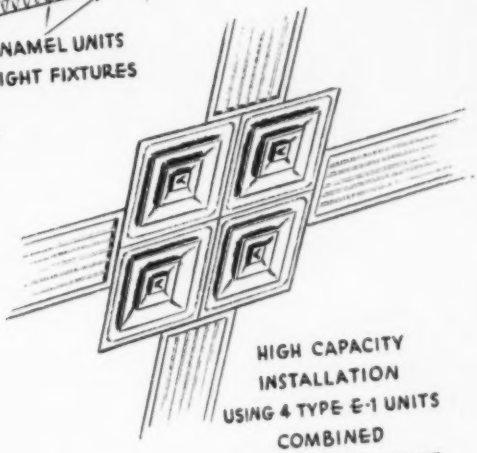


COMBINATION TYPE E WITH FLUORESCENT LIGHTING SIMILAR TO INSTALLATION IN UNITED NATIONS OFFICE

WHITE ENAMEL UNITS MATCH LIGHT FIXTURES



APPLICATION OF TYPE E-1 WITH LIGHTING FOR COMMERCIAL INSTALLATION



HIGH CAPACITY INSTALLATION USING 4 TYPE E-1 UNITS COMBINED WITH FLUORESCENT LIGHTING

Anemostat Air Diffusers offer unlimited design possibilities. They can be used in regular, acoustical and egg crate ceilings . . . combined with all types of lighting fixtures . . . in commercial, industrial and home applications. Anemostat Air Diffusers provide uniform diffusion throughout the entire conditioned area. They eliminate harmful drafts, stale air pockets and equalize temperature and humidity. New Selection Manual contains complete application and specification data. Write for your copy.

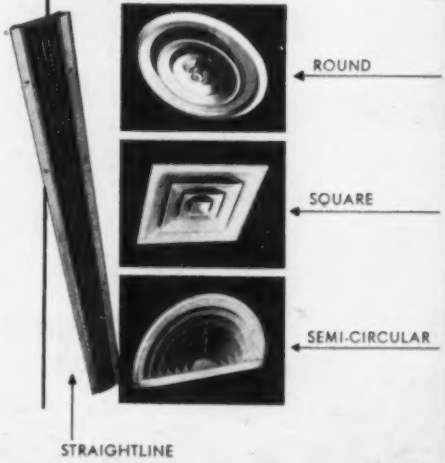
"No air conditioning system is better than its air distribution"

ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

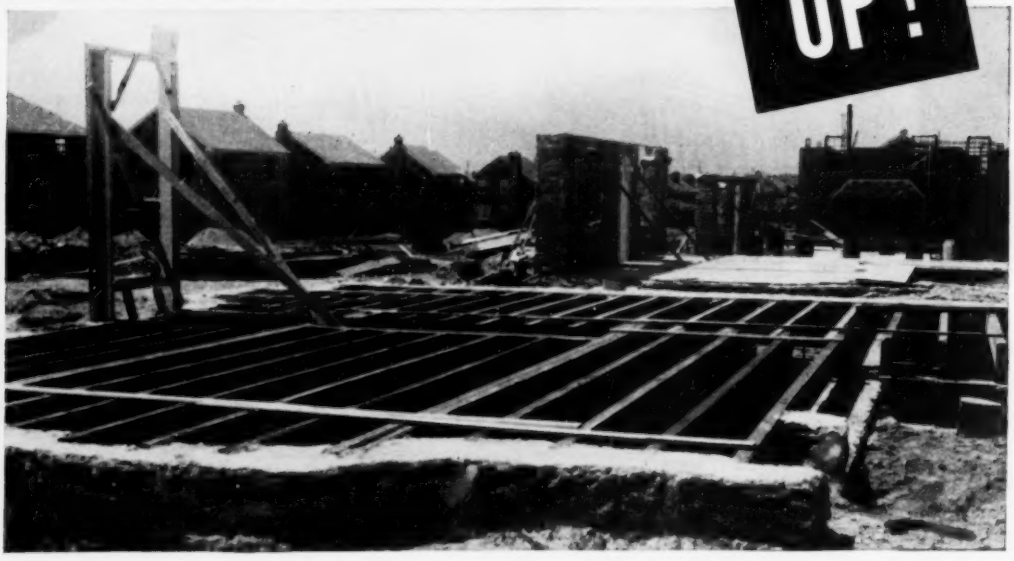
ANEMOSTAT CORPORATION OF AMERICA, 10 EAST 39th STREET, NEW YORK 16, N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

ANEMOSTAT offers maximum design possibilities because only Anemostat Air Diffusers come in all these shapes



AC12

from the ground UP!



Thousands of tons of steel pipe go into new homes every year from the ground up. At the turn of a faucet water flows. At the touch of a lever waste is sanitarily washed away. At the click of a thermostat room temperature changes—because the hidden servant, steel pipe, is at work. We at Wheatland are proud of the role played by "the pipe with the yearmark" in insuring the comfort and convenience of homes all over America—24 hours a day, 365 days a year.

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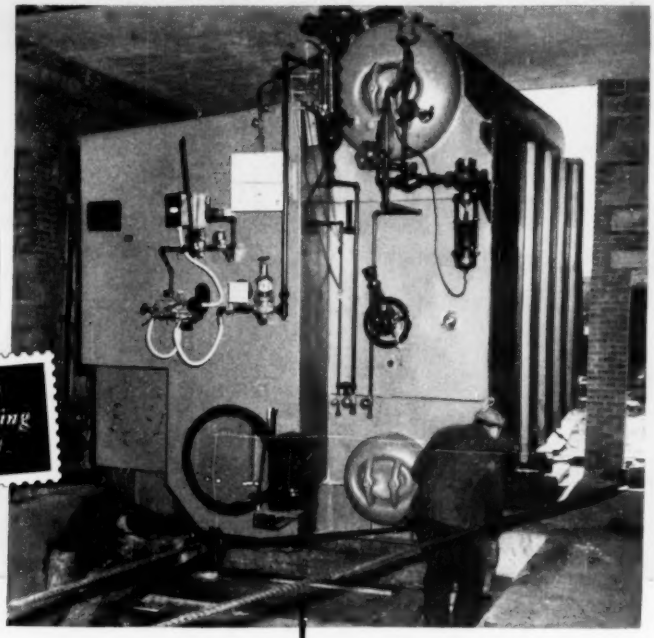

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A modern development of the original B&W Integral-Furnace Boiler, this new unit embodies the experience gained through engineering and build-over 100 million pounds per hour of installed steam capacity to the same basic design.

Small and medium size plants, institutional and commercial establishments will find in this unit all the answers to low-cost heating and process steam-generating requirements from 3,000 to 35,000 lb. per hr. at pressures to 250 psi. Large plants, too—where space and load characteristics warrant—may profitably consider several packaged boilers as against a "tailor-made" installation.

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THE EDITOR'S PAGES

● READER PARTICIPATION is a phrase one hears every now and then in business magazine publishing circles. It refers, as we understand it, to any reader-magazine relationship other than the actual reading of the articles, advertising and other published information (sending in a request for product information, commenting on a question of interest, congratulating the magazine on a particular article, for example) . . . . . Any editor—present company *not* excepted—is very happy about all evidences of "reader participation" that come his way, and we hope that you, as a reader, will make it a point to be a "participator" too. For many years, HPAC has featured its "Open for Discussion" department (the fourth page to the east from this point), which invites your comment on published articles, or your views on any matter of interest to heating, piping and air conditioning engineers or contractors . . . . . Another place where we make a standing offer for your participation is our Question of the Month columns. We'd like not only questions you'd welcome comment on, but your answers to published questions from other readers . . . . . A lot of experience in heating, piping and air conditioning work is reflected in the answers to questions published in these columns. For example, a recent request from a reader for assistance on an air conditioning operating problem has so far been answered by three published answers. One of them was from a topflight engineer with one of the country's leading contracting organizations, the second was contributed by the building superintendent of a nationally-known concern (biggest in its field), and the third by the chief engineer of a large organization who is responsible for the selection and maintenance of heating and cooling equipment in bakeries, warehouses and retail stores . . . . We point all this out so that you'll realize—if you ever doubted it—that you'll be in good company when you participate in our Question of the Month department, or in any of the other opportunities we try to include in each month's issue of HPAC.

"QUOTE"

"Without air conditioning, the modern store interior would never have been built. Modern lighting would be impossible—without an air conditioning system to offset the heat load. The open front would be impossible—yesterday's designer had to use a large part of the front for ventilation. Air conditioning has taken the store windows out above the first floor (at great saving in merchandise damage by dust and fading) and the glass off the display cases (making "tactile" selling and self-selection possible and saving the housekeeping expense of these large glass areas). Air conditioning has made it possible to replace the 8 ft high partition, once necessary for air circulation, with full length, lightweight wall sections hung from the grid of the flexible ceiling. Emergency control of air supply has been used to help make large stores fire safe.

"If merchants were originally forced to air condition to compete with the store next door, they have had the happy reward of discovering that air conditioning literally pays for itself—in relieving the usual summer slump, in greater personnel efficiency, in eliminating markdowns on sweat-damaged goods, in reduced cleaning bills.—Architectural Forum, in an article on air conditioning stores in the July 1950 issue of that magazine.

FROM OFFICE BOY TO BOARD CHAIRMAN

CHARLES G. WITHERSPOON, president and chairman of the board of Baker, Smith & Co., Inc., heating, ventilating and air conditioning contractors, New York, recently began his 61st year with the firm. Widely known in the industry, he became associated with the company July 14, 1890, as an office boy.

During his 60 years of service, Baker, Smith has done work in most of the 48 states, Canada and Europe. The firm has installed heating, ventilating and air conditioning systems in some of the world's largest buildings, including the Pentagon in Washington; the Book-Cadillac hotel in Detroit; the Strawbridge-Clothier department store in Philadelphia; the Empire State building, the Chrysler building, several Rockefeller Center buildings, and Stuyvesant Town, Peter Cooper and Parkchester apartment projects in New York.

Baker, Smith & Co. will celebrate its 100th anniversary in 1952. It was founded by William C. Baker and John J. Smith. One of the firm's chief innovations in the heating industry during the 19th century was a "patented nonfreezing, car-warming apparatus," a cone-shaped heater that for many years was considered indispensable equipment for first-class railway cars.

"WHITE ELEPHANTS" WITHOUT CONDITIONING

THE DAY WILL COME—and it's not too far off—when a house will be considered obsolete unless it has an automatic, all-season air conditioning system, W. Paul Jones, president of Servel, Inc., predicts.

"Builders, erecting thousands of houses in a competitive market, are well aware that those which offer special comfort and convenience inducements meet with greater public acceptance than ordinary dwellings," the manufacturer said.

Equipment which heats or cools on a minute's signal may be installed without increasing the cost of a new house, Mr. Jones said. It makes possible elimination of such construction features as screens, porches, expensive framing, windows that open and shut, and outdoor terraces, he stated.

MOVIE EXPLAINS WELDING, CUTTING

THE OXY-ACETYLENE Flame—Master of Metals is the title of a new 20 minute motion picture on oxy-acetylene welding and cutting. Produced in sound and color, it is the cooperative effort of the Interna-

tional Acetylene Association and the United States Bureau of Mines. The film explains what the oxy-acetylene welding and cutting processes are and what they will do.

Animated sequences show how calcium carbide and acetylene are produced, and why oxygen and acetylene are so effective in producing the "hottest flame on earth." Through animation also, the workings of welding torches, cutting torches and oxygen and acetylene regulators are explained.

Requests to borrow copies of the film should be addressed to the Supervising Engineer, Graphic Services Section, Bureau of Mines Experiment Station, 4800 Forbes St., Pittsburgh 13. Requests for information on how to purchase copies of it should be directed to the Secretary, International Acetylene Association, 30 E. 42nd St., New York 17.

ROOM A.C. UNITS INSTALLED THROUGH WALL

WHEN THE Sandpiper Villa apartment project in Miami was still in the design stage, a ¾ hp room air conditioning unit equipped with a thermostat was purchased for each bedroom, and a "through the wall" installation was planned for in the blueprints, according to Russ and Dorothy Gray, air conditioning and commercial refrigeration contractors. This type of installation makes the unit look like part of the building rather than an afterthought.

The building contractor was furnished with a wooden form made of 2 x 12's, creosoted and aluminum painted. This form allows for ample air space on the outer sides as it runs at a 45 deg angle from the inside out; also, the bottom is at 45 deg to allow hard rains to drain off and not seep into the room. The form was cemented in place. The inside mounts flush with the plaster in order to allow for attractive molding to face off the interior. The outer casing of the unit is then securely mounted and a calking gun is used to seal it in. The unit's chassis then slides into the casing from the inside and the job is complete.

Each unit was supplied with its own electrical circuit, properly fused.

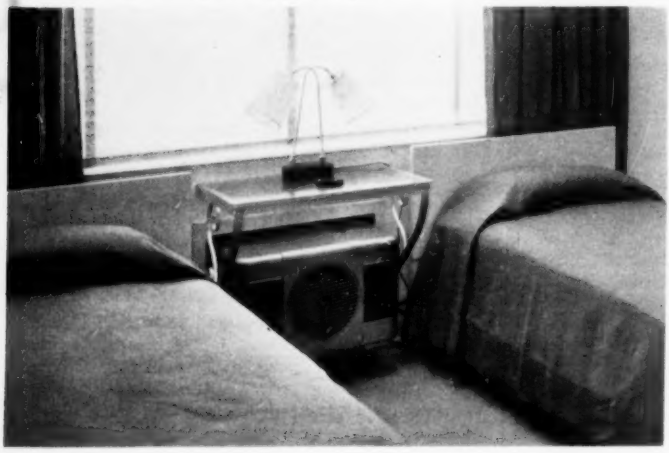
A cleverly designed night table was designed to fit over the unit, as there was no other location for such a table.

In cases where the "through the wall" type of installation is made after a building is already completed, the same method is followed; however, more time and labor is involved in making the proper size hole for the unit.

SIX MONTHS BUSINESS EXCEEDS SIX-YEAR TOTAL

W. C. NEWBERG, president of the Airtemp division of Chrysler Corp., has announced that during the first six months of 1950, the division did a larger volume of business than during the entire six years before the war—1936-1941.

Each of the bedrooms at the Sandpiper Villa apartments has a ¾ hp air conditioning unit installed through the exterior wall, making the unit look like part of the building "rather than an afterthought"



CONSTRUCTION CONTRACTS SET MONTHLY RECORD

CONSTRUCTION CONTRACT awards in the 37 states east of the Rockies in July set an all-time monthly record with a $1,420,181,000 total which was 5 percent higher than the previous all-time monthly record of $1,350,496,000 set in April of this year, according to F. W. Dodge Corp.

The July total was 6 percent higher than June's $1,345,463,000 figure, and 51 percent greater than the July 1949 total, according to the Dodge firm.

For the first seven months of 1950 construction contract awards totaled $8,274,329,000 which was 53 percent greater than the corresponding figure for 1949. The total of square feet of floor area for the first seven months of 1950 was 753,757,000, an increase of 69 percent over the comparable figure for last year.

Residential awards in July totaled $675,080,000, an increase of 7 percent over the June figure and an increase of 98 percent over the corresponding figure for 1949.

Nonresidential awards in July were $487,115,000, up 10 percent over the June total and 39 percent ahead of July 1949.

Public and private works and utilities totaled $257,986,000, a decrease of 6 percent from June's total, but an increase of 2 percent over July 1949.

NEW PROFESSORSHIP HONORS CHARLES E. WILSON

A NEW PROFESSORSHIP honoring Charles E. Wilson, president of General Electric Co., has been established at the graduate school of business administration, George F. Baker Foundation of Harvard University.

The professorship is known as the Charles Edward Wilson Professorship of Business Policy and has been established by action of the GE board of directors in recognition of Mr. Wilson's 50 years of continuous service to the company.

The Wilson professor will devote himself to research and teaching in the overall approach to business problems required by top management.

"...the best darn building in New York"

On the way to the dedication of the new Parke-Bernet Galleries a taxi-driver told William A. Delano, president of the Municipal Art Commission: "That's the best darn building in New York."

Said Mr. Delano: "If that be the judgment of a taxi-driver, I am sure it will make even stronger appeal to that decreasing number of our citizens who do not drive taxis."*

The new Parke-Bernet Galleries Building, where world-famous collections of art reach the auction block, is proof that distinction in commercial building pays. It is outstanding in every detail – from the modern classical design of Architects Walker & Poor to the heating and mechanical equipment designed by Consulting Engineers Syska & Hennessy.

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*As quoted in "Journal of the American Institute of Architects," January 1950.

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● Do YOU HAVE something you'd like to say about any of the articles published this month? An additional comment, or perhaps a question on some point? Or do you want to express your views on some other matter of interest to heating, piping and air conditioning engineers or contractors? We follow here the custom at engineering society meetings of providing an opportunity for discussion following presentation of a paper. You are invited to participate. Just address your remarks to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

RADIANT HEATING DESIGN, OPERATION DISCUSSED

I AM SORRY that I could not attend the Heating, Piping and Air Conditioning Contractors National Association convention in San Francisco this year; judging from the report published in the June HPAC, I missed a very fine meeting.

F. W. Hutchinson apparently made some very interesting comments about radiant heating and, while he may have in his possession adequate data to back up his opinions, some of them appear to me to be open to question. For example, the statement that the downward heat loss from a floor type system in concrete to the ground of "35 percent and more" should be thoroughly substantiated before placing such a handicap on radiant heating.

Before questioning the percentage figures, I wonder if it is advisable to talk about completely uninsulated slabs when good engineering practice calls for a minimum of slab edge insulation carried to a depth of 18 or 24 in. below the bottom of the slab. Such insulation frequently consists of a light-weight aggregate fill, the cross section of which is a triangle, the base of which is flush with the bottom of the slab and extends a distance of 2 or 3 ft from the perimeter of the slab toward the center. It is not uncommon for 8 in. of stone fill to be used, the air voids of which offer some resistance to heat flow. A slab of insulating concrete is also not uncommon and is considered good practice. Therefore, it seems to me that the downward heat loss under these conditions of construction would be much more valuable engineering data than some figures based on a practice not followed.

With regard to the percentage figure itself, the amount seems high if we are to believe statements that the operating cost of radiant heating systems is less than for conventional systems. This is an advantage of radiant heating that is widely accepted, and if we can add as much as 35 percent to the heating load and still have lower operating costs, then the losses from the room itself with radiant heating must be only approximately one-half of those experienced with conventional systems. Perhaps all this can be explained by the data which Professor Hutchinson is planning to publish, providing such data as details of construction, type of soil, moisture conditions, climatic conditions, water temperature, cycle of operation, piping system design, etc., are included.

I am entirely in agreement with Professor Htuchinson that we need a standard design system for floor type systems, wall systems, and ceiling systems, but I do not believe that the various authorities in the field of radiant heating have given the architects, engineers and contractors a fair chance to select a standard procedure. Thus, I do not believe they are to be criticized until the authorities can by some unified effort get together around a table of discussion and make an honest attempt to listen to the other fellow's side of the story.

I presume that when Professor Hutchinson sets 68 F as the minimum air temperature at which comfort can prevail, he is again referring to some specific test installation which he has personally observed. Such concrete statements as these add to the confusion which exists because comfort in a hospital room and comfort in a garage are two different things and the same air temperature limit is hardly applicable in both cases. I do agree that statements of comfort in a home at temperatures around 60 deg are fallacious or are based on the opinion of some individual whose physiological characteristics are far from those of the average human being.

Professor Hutchinson's statements on cooling and control were very interesting and I believe that the heating industry is more and more becoming aware of the fact that the control of radiant heating in the average building is not a serious problem that only a few experts and the most complex control equipment available can solve.

I was interested to read of the comparison of heat release from a floor system and a ceiling system. The ratio given by Professor Hutchinson appears to be based on the theoretical conclusion that a floor system can only put out 35 or 40 Btu per sq ft with a surface temperature of 85 F. As I have stated many times, including my article which appeared in the March 1949 issue of HPAC, the output capacity of floor systems under various conditions is difficult to establish by calculation. Professor Hutchinson's figures are apparently based on "natural convection", which does not take into account infiltrating cold air or downdrafts from cold exposures. This would help to close the gap between theory and practice, I feel certain. Professor Hutchinson's ratio is also based on 120 deg ceiling surface, a temperature which is decidedly above that recommended by the non-commercial Gypsum Association and manufacturers of gypsum plaster; 115 F is given as the physical limit of gypsum plaster, while comfort conditions in an 8 ft room have, under actual operating conditions, limited

the surface temperature to 100-110 F. An objectionable warm feeling about the upper extremities has been experienced with higher temperatures.

Perhaps the most important remark made by Professor Hutchinson is that concerning the tube spacing and tube diameters. Unfortunately, the change in heat output at various close spacings (9 in. and less) is no indication of what happens when spacing gradually increases from 9 to 18 in. Our research indicates that a sizable change in the unit heat release might take place in the average building but our work is not yet completed and I do not feel justified in injecting further confusion until I am prepared to substantiate my opinions with adequate data. As far as pipe sizing goes I believe that a change in pipe size has less effect than several inches change in spacing. Our work along this line is also in an uncompleted state.

Walter Oleson's report at the convention on the work of the Milwaukee contractors association is deserving of complimentary remarks for the effort alone. The contractors are very close to the installation and troubleshooting of radiant heating systems and designing engineers can well profit from their experience. I would like to have some clarification of the boiler size procedure used in the Milwaukee method. I would like to know if the added 10 percent is 10 percent over the net heating load or 10 percent over the gross load including piping and pick up allowances.

I appreciate this opportunity of expressing my opinions on the subject of radiant heating. I want to see all of the questions answered eventually and each article and each convention is a step in that direction.—PAUL S. PARK, until recently manager of the engineering service dept., A. M. Byers Co., and now consultant specializing in radiant heating.

PROPELLER FAN SUPPLIES COMBUSTION AIR

IN ANSWER TO the problem on combustion air supply and boiler house ventilation posed by "B.N." in the April issue of HPAC, I suggest the following ideas which may be of interest.

1) The combustion air should be introduced into the boiler room so that it is drawn over the boiler tops, flues and economizers on its way to the furnace fronts. In arranging for the combustion air supply in this manner, the boiler house will tend to be kept cool and combustion improved.

2) If the plant under review is being steamed on natural draft and the steam output is insufficient due to lack of draft I have found that the cheapest way of increasing the draft in more than one instance has been to put the boiler room under a slight pressure; that is, to blow into it with a propeller type fan.—A. D. G. ISHERWOOD, J. R. W. Murland, consulting engineer, Belfast.

KNOWS OF NO INFECTION FROM HOSPITAL A.C.

FROM THE ARTICLE on air conditioning hospital operating rooms, in the August HPAC, it appears that the author is trying to throw a scare into all hospital administrators, engineers, etc. Of the hundreds of hospitals that we have designed with the operating rooms air conditioned, *in not one instance* do we know of a case where infection was due to contaminated air being delivered to the operating rooms through the air conditioning system; and we would like to inquire as to exactly who determined that the infections were due to the contamination in the air conditioning system, in the case mentioned in the article.

The article notes that soot gets around the filters. This was definitely a job of poor workmanship, as no reliable contractor would install filters with space around the ends. If this particular contractor did install them this way, why was he allowed to do it?

With reference to the water required for humidity, in all cases we have used city water. This water is safe enough to drink, and we do not see how we could contaminate operating rooms with such water.

With reference to the remark made about scale deposits on the insides of ducts, if ducts are suitably insulated, no condensation forms on the interior of the duct work and no deposits from the water adhere to the duct work.

All that I can say is that in over 50 years of designing hospitals, we have never run across any such bad conditions as outlined in the article.—GERALD C. DITTMAN, Schmidt, Garden & Erikson, architects-engineers.

USE BEST TECHNIQUES IN HOSPITAL A.C.

I HAVE read with interest the article on air conditioning operating rooms, by R. A. Phelps, published in the August HPAC. Hospital operating rooms are a most important part of the air conditioning problem as here you are dealing with a number of tough variables (including the medical staff). No one can over-emphasize the importance of careful design and installation of such work.

I would like the article to be more specific in stating the contamination which occurred on the inside of the ducts. There should have been no free water to condense on the surface of these ducts but it would appear from the way the problem was described that actually water was condensed and with it dirt, causing a permanent deposit and a reaction on the metal.

It seems to me that in handling air for an operating room—or any other conditioned area where air cleanliness is of the essence—that we must be more definite in planning and insisting on good air cleaning equipment. It may well be that for this type of installation we should have air washers, electrostatic air cleaning and air purifiers so that all three methods of approach to air cleanliness can be used, each taking care of the problem which exists in the ordinary city air. No one device can do the entire job. I think we will gradually find new appreciation of the values in air conditioning if we can see to it that installations of this kind do use the best techniques.

Each of us can, in his own experience, recall many installations where the compromise was made with cost to the end result that the air conditioning not only was not satisfactory but was a hazard.

We are indebted to Mr. Phelps for pointing out hazards of this kind.—LESTER T. AVERY, president, Avery Engineering Co., and national president, American Society of Heating and Ventilating Engineers.

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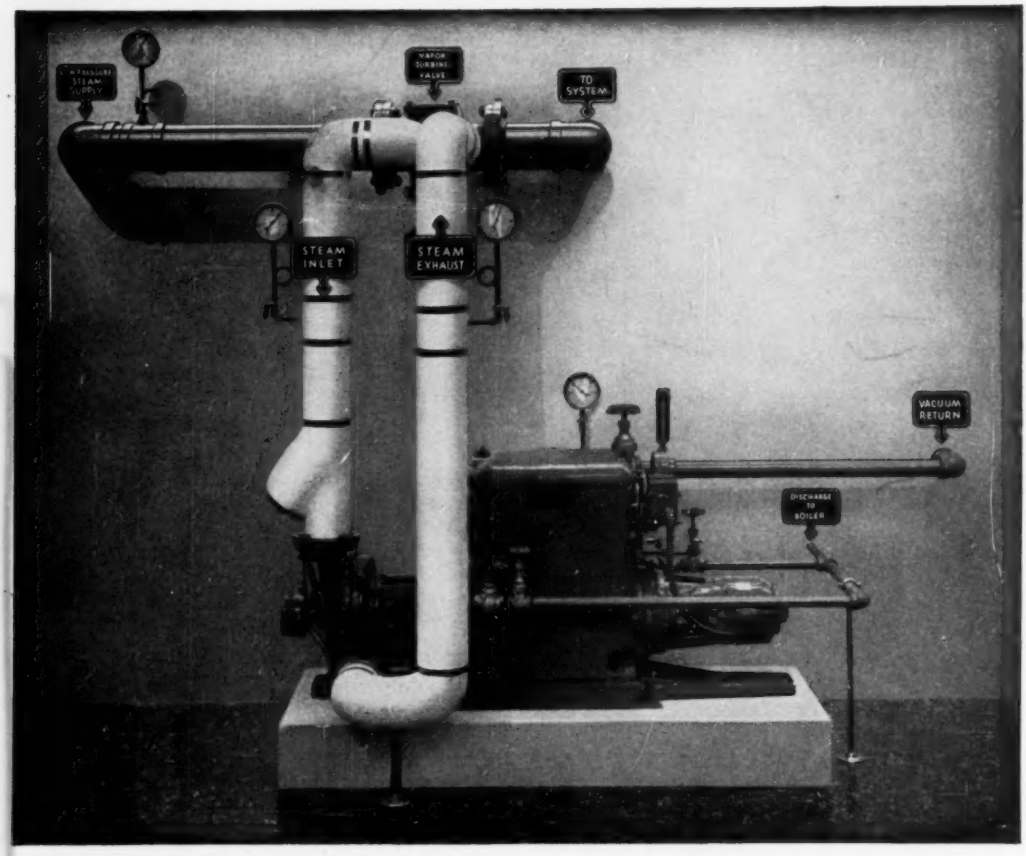

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The Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump. Bulletin on request.

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New Alcoa Office Building Uses Ceiling Heating-Cooling Panels

BARTLETT R. SMALL, staff engineer, Aluminum Company of America, gives some "field notes" on a "hot" subject—the use of aluminum ceiling panels for cooling and heating the new Alcoa 30 story office building under construction in Pittsburgh. He explains how panel cooling differs from panel heating, the test setup for determining both cooling and heating performance of the panels, use of forced air circulation as a capacity boosting feature, and the advantages of the scheme (the Alcoa building will gain a story and a half of rentable floor area)

PANEL HEATING installations in floors and ceilings have done an effective job in homes, industrial buildings, offices, and other structures. While conventional panel heating is economical from an operating standpoint, there has been considerable study and development work done with the objective of reducing installation costs.

The same prefabrication developments which have stimulated the use of large exterior metal panels and ready-made metal partitions for building construction have resulted in a growing market for ready-made metal ceilings. Metal ceilings with laboratory developed perforations and blanket sound deadeners meet the building's acoustical requirements. They can be delivered with a factory-applied final finish and a masking fabric for protection during transit and erection. If the ceiling is aluminum, it should excel as a heating surface in winter and as a cooling surface in summer because of the remarkable conductivity and choice of radiation emissivities possible with the metal.

These facts were known and considered by Alcoa's architects and engineers during the planning of the 30 story Alcoa office building now under construction in Pittsburgh. At that time, however, information on the performance and efficiency of metal ceiling panels for space cooling was limited. To the writer's knowledge, panel cooling had been tested and data published by only one authority,[1] and since then new concepts and conditions had developed. There were no recognized installations. Data regarding re-radiation effects from wall surfaces were also limited.

Panel Cooling, Heating Differ

Ceiling panel cooling performance differs greatly from panel heating, since cooling requires a different interpretation of conditions and enjoys higher panel ratings per degree of temperature difference. Panel cooling is favored by the fact that 60 to 80 percent of the total room sensible heat cooling load is produced by sun and lighting radiation. Another advantage of ceiling cooling is the rapid, natural convection resulting from the panel's overhead position; there is a possible gain of about 50 percent in convective thermal exchange compared with a theoretical floor cooling panel system.

It is difficult to determine accurately what part of the radiant heat load is directly absorbed by the panel as direct radiant energy interchange from wall and floor surfaces; i.e., heat intercepted and absorbed before it has a chance to raise wall and floor surface temperatures and thereby release heat by convection to the room air. The direct radiant heat interchange seems to be quite high with incandescent lamps, particularly the bare filament types.[1,2] Ceiling recessed fluorescent lights, on the other hand, do not radiate directly to the ceiling panels, so that panel cooling capacities are adversely affected to some extent.

Other problems also arose, such as the evaluation of desirable levels of heat transmission, tube spacing, control of emissivity, benefits from forced ceiling convection and overall heating and cooling ratings.

Test Program Developed

In an effort to solve these problems, a test program was developed cooperatively by Alfred L. Jaros, Jr., of Jaros, Baum & Bolles, consulting engineers, and the Aluminum Company of America.

The information to be gained from the program seemed to justify construction of a totally enclosed panel

[1] The Mechanism of Heat Transfer, Panel Cooling, Heat Storage, by Charles S. Leopold (Journal of ASRE Section, Refrigerating Engineering, July 1947).

[2] Removal of Internal Radiation by Cooling Panels, by Meri Baker (ASHVE Journal Section, Heating, Piping & Air Conditioning, November 1949).

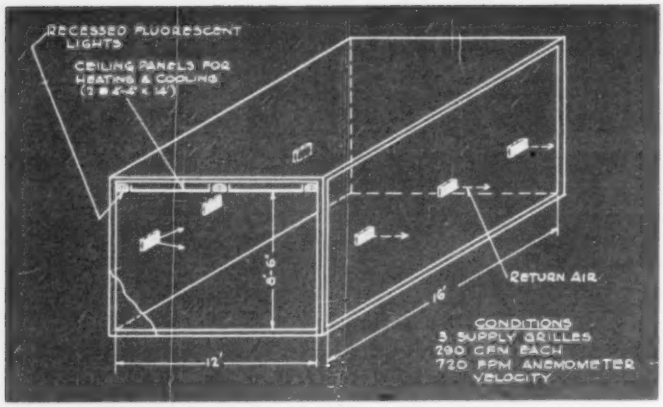


Fig. 1—A panel test room with cold air facilities to remove the heat released during the panel heating tests was constructed of the same dimensions as those of a typical office in the new Alcoa building

test room (Fig. 1) with facilities providing sufficient cold air to remove heat released during panel heating tests. Dimensions of the test room (12 by 16 by 9 ft ceiling) were the same as those of a typical office in the new building. Interior walls, exterior walls and ceiling were of insulation board, and the internal insulation was adequate, in the absence of panel radiation effect, to hold all internal wall surface temperatures to plus or minus 1.1 F of the desired test room air temperature. These temperatures were 70 F for panel heating tests and 80 F for panel cooling tests.

Fluorescent fixtures, recessed flush with the ceiling panel surfaces, provided 3 watts per sq ft of floor area, a conventional load. A sun load was simulated by a separately heated wall panel that operated during some tests at temperatures up to about 140 F. This wall panel amounted to 8 percent of the total floor and wall receiving surface area.

The ceiling panels consisted of aluminum sheets and tubes suitably bonded for heat path and rigidity. Modular size panels nearly covered the ceiling area, leaving avenues for recessed type fluorescent lighting fixtures.

In carrying out the tests, room air temperatures were held to plus or minus ½ F and entering water temperatures were controlled even more closely. After approximately a half-hour equilibrium holding period, three sets of readings were taken during a 20 min period when the temperatures were recorded.

About 72 thermocouples were used to determine the temperatures of nine room air stations, eight wall and floor surface points, several panel surfaces, air supply from conditioner and air return, and water at several panel points. Air couples had aluminum foil radiation shields and surface couples were held in place with cellophane tape as used at Yale's Pierce laboratory and Penn State's thermal research laboratory.

Internal Conductance of Panels

Panel performance was studied by considering it in two separate phases: the internal conductance of the panel, and the air side heat exchange from panel to the air and the room surfaces.

Internal conductance is really the unit rate of heat flow from water circulating in the tubes to the working face of the radiation panel. Its values vary with panel material and thickness, tube spacing and the nature of heat path from tube to sheet.

Some panels, with aluminum tubes spaced 20 in. apart in a serpentine pattern, gave an approximate average surface temperature of 110 F when water entered at 120 F. Under these conditions, the panel emission was about 60 Btu per hr per sq ft. Unit emission was approximately 6.0 Btu per hr per sq ft per deg difference between mean water temperature and mean panel surface temperature. In terms of the more popular method of rating, this is 8.7 Btu per hr per per F per linear ft of tube length, about 10 times greater than published values for tubing conventionally imbedded in plaster or concrete.

In an identical test, except for 8 in. tube spacing, the panels yielded about 35 Btu per hr per sq ft per F unit emission as compared with 6.0 Btu per hr given above.

External Characteristics of Ceiling Panel

Panel output and the proportion of convective heat can be selected to suit the physical shape of the area to be served, as Mr. Jaros points out. In a ceiling about 8 ft high, for example, a high degree of radiant heat emission would be objectionable. On the other hand, a vaulted lobby or store could be pleasant even with a release of perhaps 200 Btu per hr per sq ft of panel surface. Panel performance control is accomplished in two ways —by proper selection of panel finish to set up the desired emissivity rate, and by the design of forced air convection.

Selective emissivity for the purpose of altering the radiant heat component and its comfort effect was conveniently demonstrated with two panels located in the test room ceiling. Panel *A* was finished in a high emissivity surface, while Panel *B* was coated with a low emissivity paint. When they were adjusted to receive water at 118 F and 157 F respectively, the same sensation of radiant warmth was felt when the hand was held at a distance of 6 in.

The use of forced air circulation at the ceiling, utilizing high elevation air supply registers and a central station system, has aroused considerable interest. This condition was simulated in the tests.

The resulting air motion gave different effects, depending on whether the panel was on heating or cooling operation. Curiously enough, on cooling duty moderate forced circulation did not appreciably accelerate the overall cooling output of the panel. But on panel heating, moderate air motion in some tests almost doubled the overall output as compared to other tests closely approaching conditions of natural convection.

With this capacity boosting feature available for use, the lower ceiling panel surface temperatures required for heating should overcome the anxiety expressed by some people about uncomfortable radiant heat sensations. In fact, for a given heating load, lower rates of radiant emission are thus obtained with aluminum panels than with conventional plaster ceiling panels.

Condensation Question Is Important

The question of possible panel condensation in damp weather is of vital importance. While condensation will always remain a possibility, the techniques of dehumidification are more understood and refined today than they were even five years ago. Low dew point air supply of about 50 F is common in postwar buildings, and space dew points of 56 to 58 F are attainable with good vapor barrier techniques. Adsorbent or absorbent dehumidification is available in cases of trouble. Attractively designed, permanently locked windows are becoming available; these windows can be opened only by the window washer's key. In addition, higher cooling ratings for ceiling panels seem to assure adequate capacity without using hazardous water and panel temperatures and have satisfied the doubts of the Alcoa building committee.

Representative Heating Ratings

From some 200 heating and cooling tests, representative heating ratings are shown below for purposes of illustration. With a condition of 55 F temperature difference between average panel and average receiving surfaces of walls and floor, typical overall outputs and ceiling air movement rates are as follows:

Less than 10 fpm*..... 70 to 83 Btu per hr per sq ft panel area for all panel types

22 to 25 fpm..... 97 to 118 Btu per hr per sq ft panel area for all panel types

44 fpm .....170 Btu per hr per sq ft for highest capacity panel

For purposes of fundamental data, a minimum air motion condition was obtained by delivering 880 cfm of either heated or cooled air through a very large perforated side wall plate. This side wall plate (Fig. 2) extended over two-thirds of the wall height and over its entire length. It was backed up with cheesecloth to provide 100 fpm port velocities through the 1 in. holes and an overall face velocity of 9 fpm. With the side wall plate in use, a claim of 10 fpm at the ceiling seemed to be justified, even though an overall 2-min room air change existed.

*Insufficient ceiling air motion to turn a low velocity vane anemometer having calibration data as low as 10 fpm.

Tests Determine Cooling Ratings

Cooling rating tests were primarily devoted to 60 F entering water, although a few were run using 50 F and 70 F entering water to complete the curves.

With 80 F room air and resulting 76 F mean wall and floor receiver temperature, the total heat extraction amounted to 20 to 25 Btu per hr per sq ft of panel cooling surface with 60 F entering water.

The synthetic sun panels were then turned on. These panels had a total heat output about equivalent to that of our proposed unshaded window area. Under this greater thermal head, the ratings approached 40 Btu.

The 70 F entering water tests with 80 F room and operating sun panels gave an approximate capacity of 24 Btu.

As a matter of interest, a typical west office has a maximum sensible cooling load of about 40 Btu per sq ft of floor area with shaded west glass. With supplementary air cooling furnished by a central station system, no difficulty is expected in attaining desired summer room conditions. Of course, this air supply is fundamentally essential for summer dehumidification, ventilation and air cleaning.

Advantages of the Method

With these fundamental questions successfully answered, we can more broadly view the other advantages of panel heating and cooling by this method. Among these are:

1) Wide variety of ceiling materials and architectural treatments.

2) Possible physiological benefits of ceiling heating.

3) Rapid and positive changes of panel output, practically no lag.

4) Extremes of temperature available for emergencies. Possible 200 F panel for accelerated early morning heating-up period.

5) Utilization of floor space formerly jointly occupied by heating equipment and thick curtain walls. The Alcoa building will gain a story and a half of rentable floor area in this way.

6) Uniformity of heating surface temperature and heat distribution.

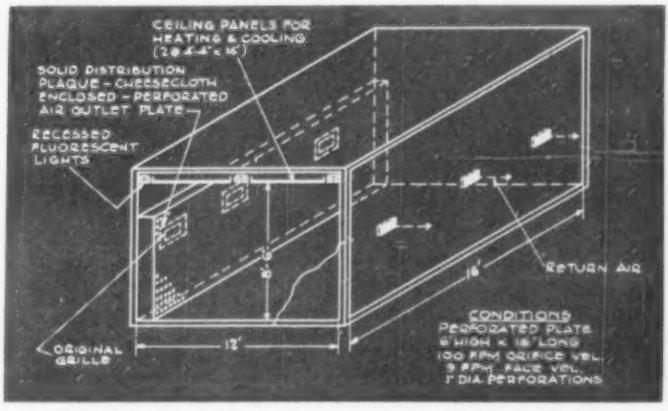
7) Absorption by building structure of peak loads in form of solar heat and lights with little effect on room temperature.

8) More uniform refrigeration load and perhaps smaller refrigeration equipment.

9) Optimum summer comfort may

[Concluded on page 97]

Fig. 2—For obtaining fundamental data, a minimum air motion in the test room was obtained by using a very large perforated side wall plate for delivering 880 cfm of either heated or cooled air



Propeller Fans Help Solve *Plant Ventilation Problems*

A FEW examples of the use of propeller fans for solving ventilation and heat removal problems in various types of factories are given here, with suggestions on the proper application of this important air moving equipment

IN INDUSTRIAL plants, the problem of ventilation with propeller fans generally requires the consideration of two factors—the removal of air for the purpose of improving comfort conditions, and fume removal. In the first case, the volume of air to be handled by the fan is determined by the air change method; generally, the fan should be selected so as to change the air every two to five minutes.

In the second case, fumes may be harmful, obnoxious, pungent, corrosive or poisonous, depending upon their source. Therefore, the method of their removal should be largely governed by their nature. In the case of vapors or dust-laden air, the collection should be made as close to the source as practical to prevent their spreading into the work area.

Overhead hoods are used for the removal of smoke, gases, vapors and fumes in many different fields of application. Generally, hoods of this type should be confined to those cases where the extracted smoke or fume laden air has a natural tendency to rise. Vapors considerably heavier than air should be removed through floor gratings or through side wall openings at the floor level.

In dealing with explosive fumes, the basic principle is to obtain sufficient air dilution to prevent unsafe concentrations or the forming of an explosive mixture. Fans for use in spaces containing vapors which are inflammable should have explosion-proof motors. In some cases, it is desirable to equip the fans with nonferrous inlet rings or spark-proof wheels.

In the case of corrosive fumes, the fans should be painted with corrosion resisting paint. In such special cases, the order should specify the special features necessary to meet the requirements.

The following examples of the wide and varied applications of fan and ventilating equipment are given to suggest the possibilities.

Flexibility in Ventilating a Cracker Factory

Several heating and ventilating problems were encountered in the design of a radically new type of cracker bakery in Atlanta. In a one story building 1200 ft long and 315 ft wide, occupying 425,000 sq ft of floor space (including the mezzanine balcony), there are practically no windows on the outside walls. The interior of the plant is lighted by day through a series of overhead sawtooth skylights.

Inside the plant, provision was made for a straight line production system extending from the reception of raw materials, through mixing and baking operations, to the sealing of cookies and crackers in their retail containers. This system involves a battery of specially-designed travelling band ovens, each of which is over 800 ft long.

In addition to removing excessive heat from the manufacturing process, vapors and odors must be exhausted from the restrooms, smoking rooms, lockers, washrooms, dressing rooms, showers, cafeteria and the first aid medical department, while suitable air conditions must be provided for employees throughout the building.

With windows and skylights sealed tight, an internal system of forced draft and mechanical exhaust provides necessary heat distribution and ventilation. As a major factor in this system, fifty-seven 36 in. self-cooled motor propeller fans located in the peaks of the monitors exhaust the excessive heat arising from the baking processes and supply outdoor air for ventilation.

In designing the heating and ventilating system, it was found that the air required for ventilation during the warm months exceeds greatly the amount of air required during the winter months. The use of propeller fans to supply the additional volume of air required in the summer resulted in a reduction in the sizes of the main ducts with a subsequent saving in installation

cost and a greater degree of control, due to the fact that the proper number of individual fans can be operated for any given climatic condition.

Cut Brewery Maintenance Costs

A brewery in St. Paul has effected an appreciable saving in maintenance costs by installing several industrial propeller fans in the room devoted to the bottle washing equipment.

Negative pressure created by these fans draws the steam developed by the bottle washing process directly to the fans. Exhausted to the outside, this moisture laden air no longer collects on side walls and structural members, thus reducing the need for painting. Caustic solutions used for bottle soaking had increased the destructive effect of hot moist air, and the saving in maintenance costs is expected to amortize the cost of the propeller fan installation within two years.

Typical installation of belt driven duct fans exhausting from a large foundry casting line. Nearly 200 fans are used in this particular application

As a dividend on the investment, the fans produce a definite comfort cooling benefit for workers during hot summer months. Allowed to run continuously, they draw in cool summer night air.

Smoke Problem in Foundry Solved

A Cincinnati steel gear and pinion company found it necessary to solve a smoke problem in a large foundry approximately 320 ft long, 60 ft wide and 50 ft high.

Because of the accumulation of smoke and monoxide gas given off by the furnaces for several hours while bringing them up to temperature, men on the floor worked under extremely poor conditions and the heat and smoke made it an almost impossible task for the crane operators. Though the building was equipped with ventilators and windows, they did not take off the large smoke content which accumulated rapidly and remained trapped in the building for some length of time.

Many schemes were devised and several experiments were made, none of which was satisfactory. Finally, sixteen 36 in. self-cooled motor propeller fans were installed, twelve of them in the side wall and four in the skylight. The result has been good working conditions, secured inexpensively, as the heat and smoke are exhausted quickly and efficiently from the foundry building.

ALCOA BUILDING—

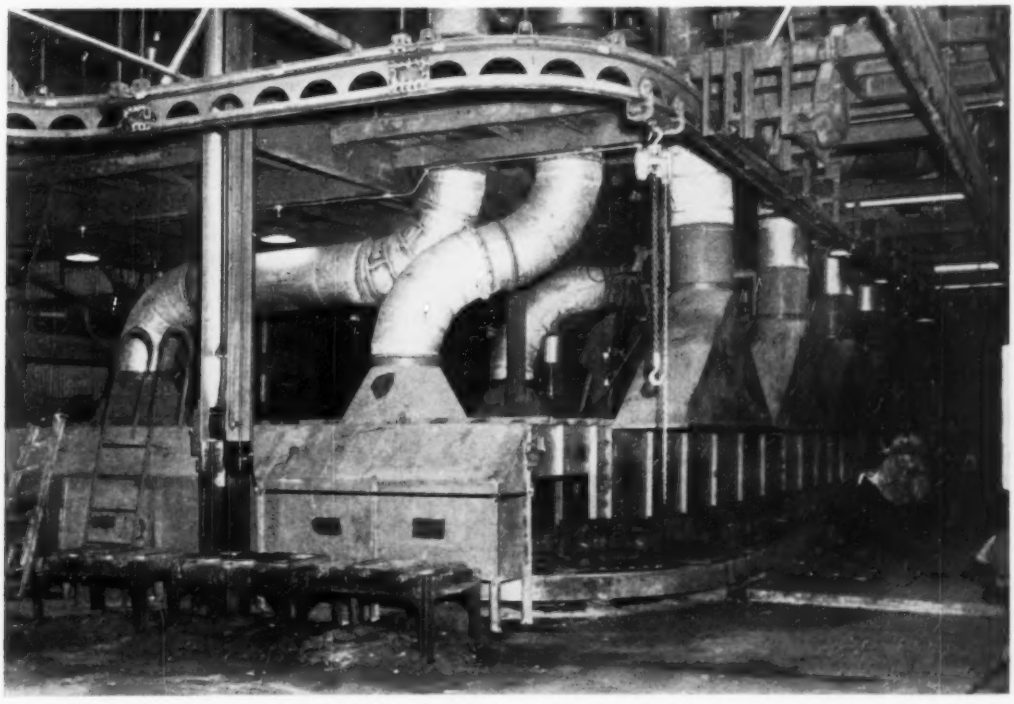
[*Concluded from page 95*]

be more economically obtained when ceilings are cooled perhaps 15 F below room air temperature and partitions also become cooling surfaces. (Wall thermocouples show temperatures below room air readings.)

10) Wide latitude for reduced size of ducts, shafting and air handling equipment.

These field notes may serve to reflect some of the intriguing issues that seemed to unfold continually in this study. Considerable effort and skill were used in developing initial predictions of heat transfer and panel characteristics, plus subsequent field data analysis and redesign.*

*By H. M. Short and P. J. McCarthy, Alcoa staff engineers, and E. S. Howarth, department head, Aluminum Research Laboratories.



Technicians plotting an oil exploration map at the new Gulf laboratory work in a carefully controlled atmosphere which protects delicate instruments, the map itself, and their own comfort and efficiency

High Pressure Conduit System Air Conditions Oil Laboratory

C. L. BUHRMAN, of the Carrier Corp., describes the conduit type air conditioning system installed in the long two-story building housing the Gulf Research & Development Co.'s new geophysics laboratory near Pittsburgh. Features of the system include a special high speed conduit fan operating at 8 in. total static pressure and handling 20,000 cfm of dehumidified primary air, which is supplied to 164 room units. . . . With this system, the functions of sensible and latent heat removal are separate, allowing individual room control in the many offices and laboratories

AN INTERESTING installation of a conduit type air conditioning system on a horizontal basis in a long two-story building, rather than vertically as in many of today's skyscrapers, has been made in the new geophysics laboratory of the Gulf Research & Development Co. at Harmarville, near Pittsburgh.

The main building is 340 ft long and 44 ft wide with two 125 ft wings extending at right angles. It has been described as "the world's most modern and complete laboratory to be used entirely for the scientific direction of prospecting operations." The offices and laboratories on the first and second floors are furnished with architecturally built-in air conditioning units. The basement holds equipment for the air conditioning system along with storage rooms and additional laboratories. The entire roof of the building is kept flooded with a 2 in. water level in order to minimize the sun heat gains.

The precise control of indoor climate through summer and winter air conditioning aids the search for oil by preventing swelling or shrinkage of delicate maps that make up Gulf's multi-million dollar collection. In the plotting rooms, where technicians work on huge maps of areas that have been explored for oil with airborne and other instruments, changes in humidity could easily result in errors in scale.

The system also allows occupants of the scores of different labora-

tories and offices to regulate their own indoor weather, so that atmospheric conditions in one laboratory may differ from those in the one next door. Dust and excess moisture also are kept away from delicate scientific instruments.

A large auditorium at one end of the main building is air conditioned with a separate system. A self contained unit of 10 ton capacity provides temperature and humidity at comfort levels adjustable to winter and summer requirements for this space.

Fan Operates at 8 In. Pressure

The air cycle of the main system consists of dry type replacement filters, nonfreeze preheater and reheater coils, a spray type dehumidifier, and a high speed special conduit fan operating at 8 in. total static pressure and handling 20,000 cfm of dehumidified air. Also installed in the air cycle is a fan unit used for handling 6500 cfm of return air from the corridors on first and second floors.

The air conduits are extremely small in diameter and deliver the air at 3300 fpm in the headers and 2500 fpm through the branches to the room units. The air for the single zone system requires only ventilation air plus 6500 cfm of air which can be outside or return air.

The conduit headers and branches are considerably smaller than conventional ductwork due to two things: First, only about 20 percent of the air quantity of a conventional low pressure system is handled, since it is only primary air and because of the higher temperature difference. Second, in view of this lower air quantity, considerably higher pressure drops may be tolerated without increasing fan horsepower, with the result that much higher air velocities can be used.

Air Passes Through Sound Absorber Headers

The air is distributed from the high pressure fan through 16 ft of sound absorber headers and horizontal conduit headers located under the ceilings of the basement and first floor. They extend along the outside walls of the building. The air headers in the basement are insulated, since this space is not conditioned. Extending from the headers are 3 in. flexible runouts connecting to the recessed room units on the first and second floors.

The primary air enters the unit through a balancing damper, passes through a specially designed sound absorbing plenum chamber, and thence through the induction nozzles, having 1.60 in. static pressure. This induces approximately three additional volumes of recirculated air through the unit's heating-cooling coil. There are 76 units on the first floor and 88 on the second floor.

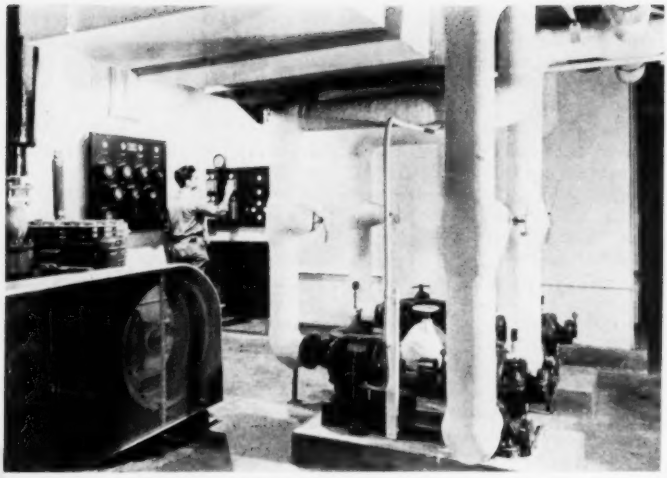
The return air system delivers the air to the primary air system or to the apparatus room, where it is exhausted outdoors through propeller type fans.

Primary Water System Handles 400 Gpm

The primary chilled water system, handling 400 gpm, is made up of two primary chilled water pumps, two direct expansion water coolers and two four-row maximum circuited coils, arranged for parallel flow and located in the dehumidifier. The 40 F water leaving the chilled water coolers is pumped in series first to the dehumidifier coils and then to the room units in the secondary water system.

It is desirable to carry out all the dehumidification in the primary system through utilization of 40 F water and thus to preclude the condensation of moisture on the room unit coils. This is assured by the higher temperature water which is supplied to the units. The unit coils provide only sensible cooling to take care of sun load variations and variations in lights and people. Having dry coils minimizes the collection of dirt and odors. From the units, the chilled water is either recirculated through the secondary water system or returned to the coolers

The air discharge grille of the room unit is in the window stool and the recirculating grille is in the front steel panel. The horizontal conduit header at the ceiling supplies the room units on the floor above through flexible runouts



One of the four 50 hp reciprocating compressors for air conditioning is at the left, and the chilled water circulating pumps are in the right foreground. In the background, the operator is adjusting the air conditioning controls

in the primary water system. The direction of flow is controlled by a three-way mixing valve.

The secondary water system consists of two secondary water pumps, two heat exchangers and the room unit coils. The secondary system picks up 50 F water from the primary system along with some return water from the units, if necessary, depending upon room loads and outside weather conditions.

In the heating season, the refrigeration system is shut down along with the primary water loop. The secondary water system then performs the sole role of circulating 130 deg hot water to the room units by means of passing the water through the two shell and tube type heat exchangers.

The steam system, operating under 5 lb pressure with a vacuum return, supplies the necessary low pressure steam to the single row preheaters and reheaters in the air cycle and to the two heat exchangers in the secondary water system.

Four Reciprocating Compressors

The refrigeration system is comprised of four reciprocating compressors having a total capacity of 200 tons of refrigeration. One is a standby compressor. They operate at 33 F suction temperature and 105 F condensing temperature under peak load conditions. The four 50 hp belt driven compressors are isolated with spring mounted concrete bases to eliminate vibration and noise transmission through the building. To further insure against vibration, the suction and hot gas lines are equipped with flexible connections to each compressor.

Completing the refrigeration cycle are four water cooled condensers each supplied with 100 gpm of 85 deg water. This condensing water is supplied from a central spray pond which serves other buildings. Two shell and tube water coolers handle a total of 400 gpm of water, cooling it from 50.8 F to a leaving temperature of 40 F. The coolers are controlled by thermal expansion valves and have low temperature protective thermostats operating at 35 F suction temperature.

Year 'Round Automatic Control

The year 'round automatic control system is a single zone primary air and secondary water system with automatic room control of the room units. During the cooling season, the 40 F water supplied to the eight row maximum circulated primary chilled water coils located in the dehumidifier is controlled by a thermostat in the leaving water line of the coolers. This thermostat controls four switches in the compressor electric control system. As the refrigeration load increases, more switches are energized until all four compressors are operating. Conversely, as the load decreases, the switches are de-energized in successive steps until all four compressors are inoperative.

The 40 F water, after passing through the dehumidifier, has picked up 10 F and the resulting 50 F water is passed on to the secondary system, through the three way mixing valve. This valve is controlled by a thermostat set to maintain 50 F water. The return water from the units and the water from the primary air coil are mixed to maintain 50 F supply water to the secondary system. On extremely hot days, the three way valve is open only to the primary air coil, but on cooler days the water is mixed in proportionate quantities as described above. The 100 percent outside air which is supplied to the room units, except during extremely hot and cold outside temperatures, is dehumidified to 48 F saturation during the cooling cycle.

On extremely hot days in summer, the summer dewpoint thermostat opens the return air damper to satisfy the 48 F apparatus dewpoint.

Temperature, Moisture Control Are Separate

A feature of this type of air conditioning system is the separation of the sensible and latent heat control functions, which is accomplished by supplying conditioned primary air, at constant volume, to the room units, which are equipped with heating-cooling coils in the recirculated air circuit. Room temperature may be adjusted in the room by simply throttling the secondary water flow through the coil without throttling the primary air flow. Independent of this, the primary air system is designed to maintain the required humidity by control of the primary air dewpoint.

A basic reason for separating the latent and sensible heat functions is to provide individual room control. In this manner, the system allows the many different laboratories and offices to regulate their own temperatures by throttling the water flow through each room without sacrificing humidity control.

To make the zoning of the building unnecessary and to make the

seasonal changeover temperature non-critical, the conduit system provides two sources of capacity on the heating cycle and two on the intermediate cooling cycle. In the heating season, when hot water is supplied to the room units, the primary air is cool. In the intermediate season, cold water is supplied to the room units, and the primary air is warm. In the cooling cycle, both water and primary air are cool. The room coil units were selected for sufficient additional capacity to compensate for the temperature of the primary air, and the throttling of the water flow below a certain point permits cooling of one room while adjacent rooms are being heated or heating it while others are being cooled.

At intermediate seasons, when the weather varies from 55 to 80 F, the fan discharge thermostat varies the temperature of the delivered air from 80 down to 53 F as determined by the outdoor thermostat. During this range of outdoor temperature, cold water and warm air are supplied to the room units.

When the seasonal changeover outdoor thermostat drops below 55 F, the system automatically goes on the heating cycle. The submaster thermostat in the water line leaving the heaters controls the water temperature by operating the steam supply valve to the water heaters. The control temperature varies from 80 in 70 F weather up to 130 in minus 10 F weather by the pilot pressures produced by the outdoor master thermostat used for the heating cycle. As mentioned in one of the preceding paragraphs, on extremely cold days when the outdoor temperature drops to 20, the return air damper begins to open and is fully open at minus 10 F. Saturated air at 53 F is supplied to room units in the heating season, humidification being provided by dehumidifier recirculating sprays.

Each room unit is provided with an automatic water valve which is controlled by a room thermostat.

The thermostat is direct acting during heating operation and reverse acting during cooling operation. The switchover is accomplished by changing the pressure of the air supplied to the thermostat.

Dravo Corp. was the contractor for this air conditioning system.

SPECIAL DIFFUSERS FOR DEPARTMENT STORE JOB

THE PROBLEM faced by existing stores in equipping their buildings with modern air conditioning without disruption of activity and prohibitive sacrifice of sales space has been solved by Kaufmann's, Pittsburgh department store, where the new air conditioning system serving the entire top 12 floors and augmenting the basement and main floor systems was installed without giving up sales, office or storage space, and without disturbing existing lighting fixtures, sprinkler heads or decorations.

Major feature of a $2 million modernization program, the system will have an ultimate capacity of 1650 tons of refrigeration. Central conditioning equipment in a new penthouse serves the entire system. The more than 400,000 cfm of cleansed, cooled and dehumidified air is conducted throughout the store through more than five miles of small shallow ducts at a velocity of about 30 mph and discharged through 3500 special air diffusers. Four existing elevator shafts in the approximate center of the building house the main vertical ducts required to supply and return the air to and from each floor but this was more than compensated for by the substitution of 12 new high speed elevators as part of the modernization plan.

The method of air distribution and diffusion is unique, the system being the first to utilize the high velocity or conduit principle for the large interior zones common to big department stores. The principle, which relies on supplying less air at colder temperatures through small ducts at consequent high velocity, enabled the network of small distributing ducts to be located alongside and flush with existing beams so as to be practically obscured. Since these branch ducts had to be of uniform size regardless of the amount of air flowing through any one portion of the duct, the air outlets had to be adjustable to discharge the required air volume at the same outlet velocity over identical areas, regardless of the air pressure behind them and without creating noticeable air noise, uneven temperatures or objectionable drafts.

These special air diffusers were "proved" in a trial bay under actual store conditions. Each diffuser discharges between 90 and 180 cfm of air over an area of about 150 sq ft at an outlet velocity of 2400 linear fpm and intimately mixes the discharged air with the store air so that uniform draftless air movement is achieved. The diffusers are adjustable to regulate the air supply to suit load and traffic conditions and are lined with glass fiber sound absorbing material. (Photo courtesy W. B. Connor Engineering Corp.)

The special air diffusers for the Kaufmann department store air conditioning system were "proved" in a trial bay under store conditions. Each discharges between 90 and 180 cfm over an area of about 150 sq ft

Types of Joints for

WELDED PIPING

THE VARIOUS types of joints used in welded industrial piping systems are described and illustrated here, with practical comment on their respective applications and notes on their proper use. A discussion of backing rings, and how and why the different kinds are used, is included

THE MOST common type of joint employed in the fabrication of welded pipe systems is the circumferential butt joint. It is the most satisfactory from the standpoint of stress distribution. Its general field of application is pipe to pipe, pipe to flanges, pipe to valve and pipe to fitting joints. Butt joints may be used for all sizes, but fillet welded joints can often be used to advantage for pipe 3 in. and smaller in diameter.

Standard Bevels for Industrial Piping

While there are no universally accepted welding grooves, the bevels shown in Fig. 1 are now considered for all practical purposes as standard for industrial piping. These bevels appear in the American Standard for Steel Pipe Flanges and Flanged Fittings, ASA B16e, and in the American Standard for Butt Welding Fittings, ASA B16.9, as recommended practice and much of the piping fabricated since publication of ASA B16e has been furnished with one or the other of them. For oxyacetylene welding there is some preference for a 75 or even a 60 deg groove angle for all pipe thicknesses, and some fabricators, particularly those using the forehand techniques, prefer a 90 deg groove angle.

When pipes or vessels of unequal wall thickness are to be welded, care should be taken to provide a smooth taper on the edge of the thicker member. The length of the taper should be at least four times the offset between the pipe or vessel thicknesses, as outlined in Par. P104(d) and Par. U-72(e) of the ASME Power Boiler Code and Unfired Pressure Vessel Code, respectively. The two methods of alignment which are recommended are shown in Fig. 2.

The wall thickness of cast steel fittings and valve bodies is normally greater than that of the pipe to which they are joined. In order to provide equal thicknesses for welding, the ASME Power Boiler Code permits the machining of the cylindrical ends of cast steel fittings and valve bodies to the nominal wall thickness of the adjoining pipe, provided these areas are finish-machined both inside and outside and are carefully inspected. The machined ends may be extended back in any manner provided the longitudinal section comes within the maximum slope line indicated in Fig. 2. The transition from the pipe to the fitting or valve end at the joint must be such as to avoid sharp re-entrant angles and abrupt changes in slope.

Fillet Welded Joints

Circumferential fillet welded joints are generaly used for joining pipe to pipe, pipe to flanges, pipe to valves and pipe to socket joints in the smaller sizes—i.e., about 3 in. and under. This type of joint is particularly suited for these applications because it accomplishes in small-size pipes, without backing rings and without restricting fluid flow, what is accomplished in large-size pipe by the use of backing rings. The fact that a backing ring appreciably reduces the internal area of small diameter pipe precludes its general use in that field.

Fig. 3 illustrates three typical fillet welded joints. Since this type of weld is subjected to shearing and bending stresses, adequate penetration of the pieces being joined is a positive requirement. This is particularly important with the socket joint since the danger of "washing down" the end of the hub may obscure, by reason of fair appearance, the lack of a full and sound fillet weld. This condition is one which cannot be detected in the finished weld by the usual visual inspection aids.

The chapter on industrial piping of the new third edition of the American Welding Society's Welding Handbook—from which this material has been taken by special permission—was prepared by a committee consisting of D. H. Corey, The Detroit Edison Co., chairman; A. N. Kugler, Air Reduction Sales Co.; J. D. Mattimore, Tube Turns, Inc.; J. Hall Taylor, Taylor Forge & Pipe Works; H. Weisberg, Public Service Electric and Gas Co.; and C. C. Zimmerman, Benjamin F. Shaw Co.

Intersection Type Joints

Intersection joints—such as medium and large size welded tees, laterals, wyes, openings in vessels, etc.—are usually the most difficult to weld. In consequence, factory-made wrought steel fittings conforming to ASTM Specification A-234, Factory-Made Wrought Carbon Steel and Carbon Molybdenum Steel Welding Fittings, are preferred for accomplishing the layout of the piping system, since they provide bursting strengths equivalent to that of pipe of the same weight or schedule, and their installation involves butt welds only. Machines for oxygen cutting and beveling header openings and branch ends are available, but not in general use. Cutting and beveling is usually done manually with an oxyacetylene cutting torch.

Fig. 4 illustrates two forms of preparation for 90 deg intersection joints. In one, the header opening is sufficient to permit insertion of the branch, and the header opening only is beveled. In the other, the header opening is equal to the inside diameter of the branch, and the branch only is beveled. The latter form permits the use of a specially shaped backing ring if desired.

Unreinforced branches, as illustrated in Fig. 4, are adequate only where the pipe is to be used at pressures considerably below its full capacity, usually between 50 and 75 percent of the pressure which the run of the pipe can safely withstand. In order to make 90 deg intersections equivalent in strength to the pipe from which they are fabricated, reinforcing is required. Reference should be made to Par. 634 (c) of the ASA Code for Pressure Piping or Chapt. 5 of the Standard Manual on Pipe Welding of the Heating, Piping and Air

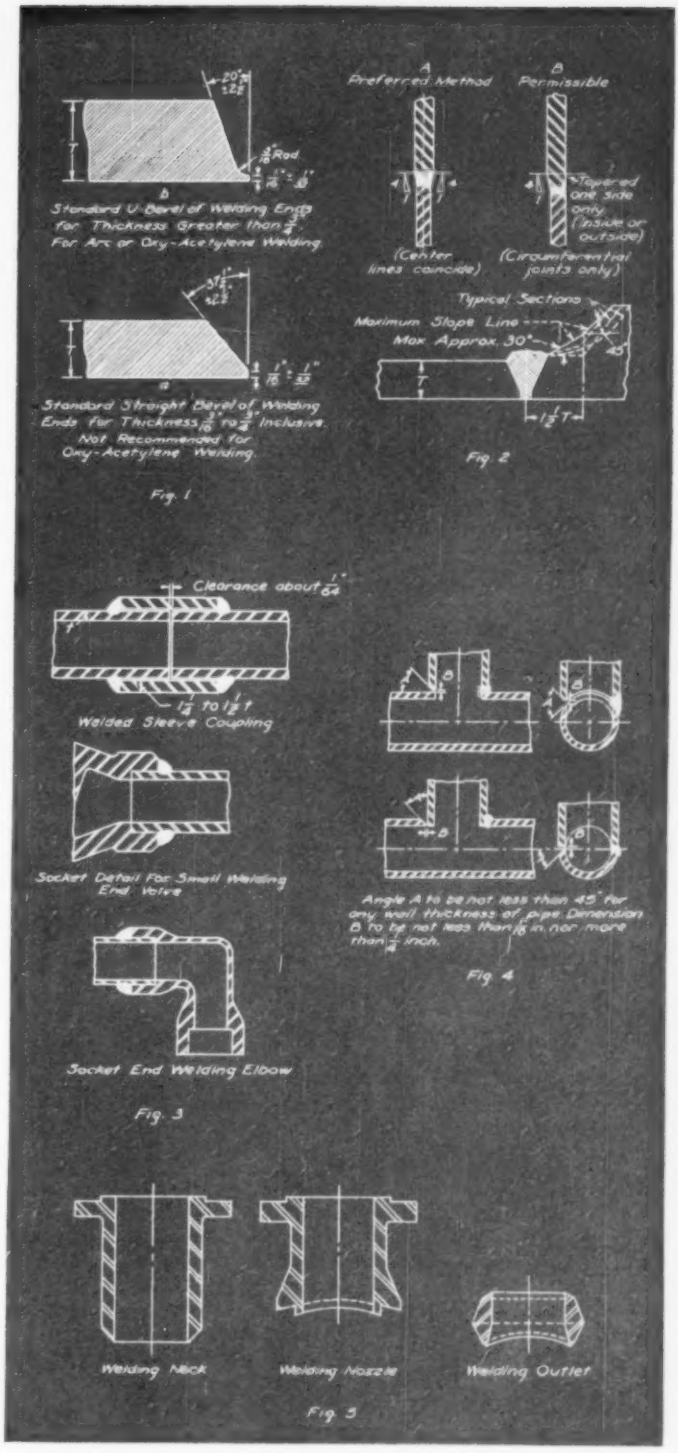

Standard U-Bevel of Welding Ends for Thickness Greater than 3/4" For Arc or Oxy-Acetylene Welding
Standard Straight Bevel of Welding Ends for Thickness 3/16" to 3/4" Inclusive. Not Recommended for Oxy-Acetylene Welding.
Fig. 1
A Preferred Method
B Permissible
(Center lines coincide)
Tapered one side only (inside or outside)
(Circumferential joints only)
Typical Sections
Maximum Slope Line
Max. Approx. 30°
Fig. 2
Clearance about 1/64"
1/2 T to 1 1/2 T
Welded Sleeve Coupling
Socket Detail For Small Welding End Valve
Angle A to be not less than 45° for any wall thickness of pipe. Dimension B to be not less than 1/8 in. nor more than 1/4 inch.
Fig. 4
Socket End Welding Elbow
Fig. 3
Welding Neck
Welding Nozzle
Welding Outlet
Fig. 5

Fig. 1—Commonly used edge preparations for pipe welding

Fig. 2—Typical welding end sections for valves and fittings of unequal thicknesses

Fig. 3—Typical fillet welded joints

Fig. 4—Acceptable types of preparation for 90 deg intersection welds

Fig. 5—Typical nozzle, neck and welding outlets

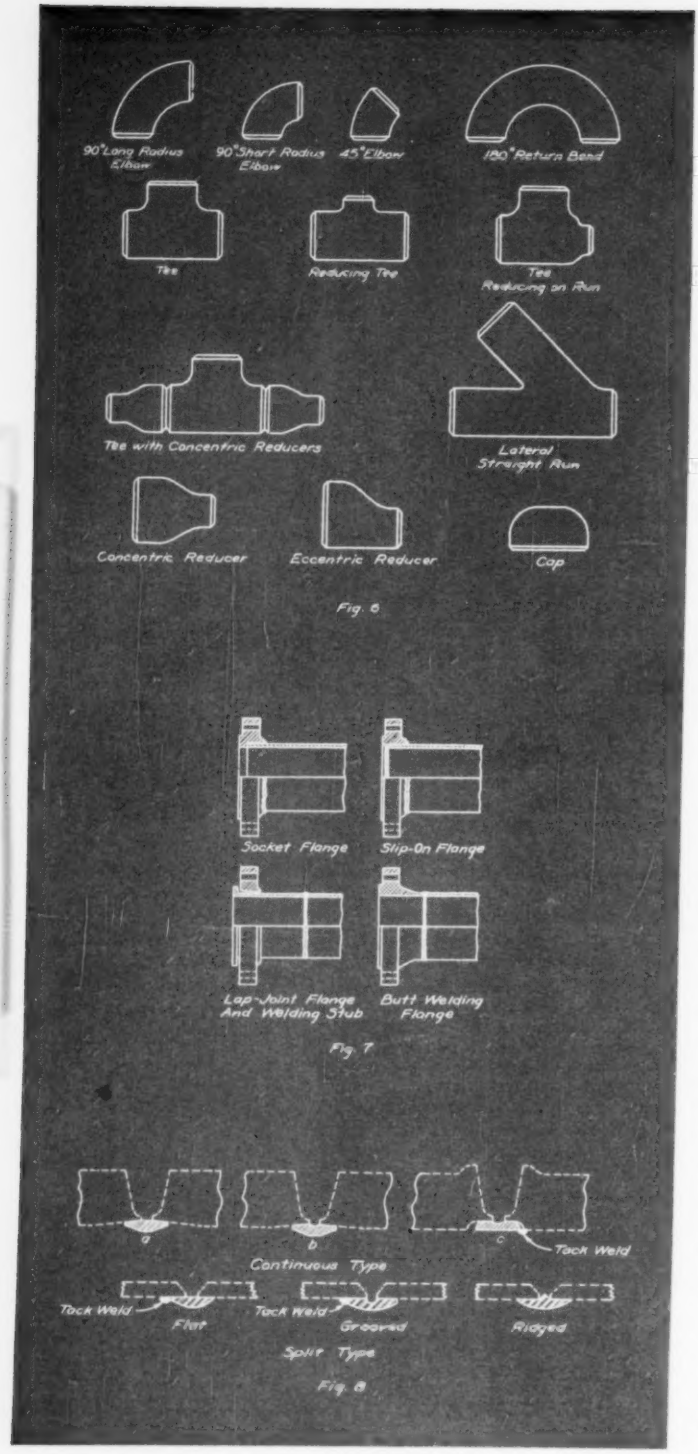


Fig. 6

Fig. 7

Fig. 8

Conditioning Contractors National Association.

The intersection of two pipes at an angle of 45 deg or less produces a condition at the crotch of the intersection which makes it difficult, if not impossible, to secure the degree of penetration and soundness of weld deposit that is considered essential for severe service conditions. Such intersection welds should be avoided for service where the pressure exceeds approximately 125 psi. Piping should be designed, whenever it is at all possible, so that all intersection joints regardless of angle can be made under shop conditions, where work can be positioned for welding in the flat position.

Manufacturers today have simplified the problems of the fabricator by providing factory-made welding type nozzles, welding necks and welding tees, and other types of outlets especially for welding which eliminate a great deal of the cutting, tacking and fitting previously required in this type of construction. Typical nozzle, neck and welding outlets which can be used for almost all ranges of sizes are shown in Fig. 5.

Welding Fittings Offer Many Advantages

Manufacturers have kept pace with design for welding by providing a line of fittings especially for welding and available in most grades of material suitable for welding. These fittings can be obtained in many combinations of size and thickness, and combining the best characteristics for unimpaired flow conditions with ease of welding and ready procurement, they make the use of mitered construction obsolete. Some typical fittings for welding are shown in Fig. 6. Manufacturers' catalogs should be consulted for further details and dimensions.

Welding flanges are also available in either the socket, slip-on, lap joint type for use with welding stub ends of butt joint type. These are shown in Fig. 7. The use of slip-on and socket types is usually restricted to services not exceeding 300 psi, since the applicable ASA

Fig. 6—Typical manufactured welding fittings
Fig. 7—Typical welding flanges
Fig. 8—Typical backing rings

Standard (B16e) does not include slip-on flanges for pressure ratings above 300 psi and does not include socket weld flanges at all. Butt joint and lap joint types for use with welding stub ends are not subject to such restrictions.

Backing Rings and Their Use

The term "backing ring" is applied to a ring-shaped structure which is fitted to the inside surface of the pipe prior to welding. Its function is to assist the welder in securing complete penetration without burning through, to prevent spatter and slag from entering the pipe at the joint, and to prevent the formation on the inside of the joint of irregular shaped masses of metal, sometimes called icicles or grapes.

Backing rings also assist materially in securing proper alignment of the pipe ends. They are used extensively in the welding of piping for severe service conditions, where internal cleaning cannot be carried out subsequent to welding and where the elimination of spatter is essential for the protection of valves, turbine blading, gears, etc.

Many different shapes of backing rings are used, as well as a special type end preparation in which a lip is formed and subsequently rolled inward, designed to serve as a substitute for a separate ring. The fact that so many designs are being used is indicative of the lack of agreement among engineers as to what constitutes an acceptable ring, and seems to justify a somewhat detailed discussion of the subject.

It is convenient to classify backing rings as two types: split or continuous. Split rings are, in general, designed to fit the inside diameter of the members to be joined without any preparation of these parts to receive the rings. The outstanding characteristic of such rings is that being split, they may be slightly contracted or expanded to fit the inside diameter snugly.

Because of the variation in diameter of commercial piping, it is impossible to make such rings to dimensions which will fit all pipes of a given size and weight without having a rather large gap when the pipe variation is at a maximum (on the large side) or without cutting the ring to make it fit when the pipe variation is at a minimum (on the small side). The usual commercial practice is to make the rings of dimensions such that the gap will be 3/16 to 1/4 in. for pipe of nominal dimensions. When the two pipe ends are not of the same inside diameter, split rings will fit snugly only against the smaller of the two pipes, and there will be a gap between the ring and the inside wall of the larger pipe. This condition is not considered serious in the welding of piping for moderate service conditions. However, the desire to provide a design which would insure a snug fit between ring and pipe ends, even when the pipe ends are of slightly different diameters, has led to the introduction of a second type of backing ring, commonly termed continuous rings.

The use of continuous rings requires that the pipe ends be specially prepared by machining, grinding, flaring and in some cases by upset forging or by building them up with weld metal. Since preparation of the pipe ends is an added expense and since the rings themselves are more expensive than the split type, their use is generally restricted to piping systems designed for the most severe service conditions. Typical joint designs using backing rings are illustrated in Fig. 8.

Outer Surface of Various Forms

The outer surface of backing rings—that which bears against the inside wall of the pipe—is provided in various forms. Split rings are provided with flat, ridged and grooved surfaces; continuous rings with flat and grooved surfaces (see Fig. 8). The flat surface was the original form and is still considered by some as the best for arc welding. The grooved surface was found necessary for gas welding and is now considered by many as superior to the flat surface for arc welding. The ridged surface was intended to provide a means for properly spacing the pipe ends. It does that, but at the expense of making it difficult (if not impossible) to secure complete penetration, and is not now used to any great extent.

It is generally agreed that the ring thickness should be the least possible in order to minimize the pressure drop. It is recognized, also, that the required thickness is related to the root opening. For root openings of approximately 3/16 in., which are most commonly employed, experience indicates that a 1/8 in. thickness is about the minimum which will permit complete fusion of the weld root without burning through the ring.

Various widths of backing rings have been used, but there seems to be general agreement now that 3/4 in. is satisfactory for all except very small or very large pipe sizes. For pipe sizes exceeding 12 in., a 1 in. width is common. For pipe sizes 3 in. and smaller, a 5/8 in. width is sometimes used in order to provide a better fit in welding elbows.

Correct Spacing Is Important

Correct spacing in abutting pipe ends is of paramount importance in assuring sound welds. One way of accomplishing the proper spacing is to apply clamps, but these are heavy and costly to use. The tapered continuous ring illustrated in Fig. 8 automatically, by its design, provides the desired spacing. The split ring having a ridged surface also provides the desired space but, as mentioned previously, is not now in general use.

Rings with flat or grooved surfaces may readily be made to provide the desired root opening by utilizing spacing pins. Two methods of attaching such pins have been used. One method involves drilling holes around the circumference (three holes, 120 deg apart, seem adequate) and either inserting loose pins, which may be removed after the joint is tacked, or solidly attaching either short or long pins. If the pins are short, say, not over 1/16 in. long, they may be welded over with assurance that they will be thoroughly fused into the first pass of weld metal. If the pins are long, they must be removed to within approximately 1/16 in. of the ring after the joint has been tacked. The second method utilizes long pins, resistance welded to the surface of the ring. The resistance weld is controlled so as to permit breaking off the pin, at the ring surface, after the ring has been tacked in place.

How Humidity, Temperature Affect Motion Picture Film

HARRY C. BRECHA, of Allied Film Service (film distributors), explains that the proper performance of motion picture film in everyday use depends to a great degree on how the properties of the film are affected by relative humidity, temperature and other factors. The importance of proper protection against moisture changes during storage, and the exercise of a certain amount of control over relative humidity in film exchanges, studios and laboratories, cannot be overemphasized, he says. . . . Mr. Brecha has had considerable experience in photographic and film handling work, bases his remarks on personal experience as well as research studies

ONE OF THE most important phases of the motion picture business is the storage of motion picture film during production, processing and distribution—and the relation of humidity and temperature to the film while in such storage. The storage of both 35 mm (nitrate base) film and 16 mm (acetate base) film are discussed here, although the latter does not require as exacting storage conditions as does the former. This is due to the fact that the majority of 35 mm film is inflammable and extreme precautions must be taken in its handling and use.

However, the storage of all cellulose products, which include not only film but paper materials, requires consistently controlled relative humidities and reasonable temperatures, for it is variation in the moisture content of the surrounding air which is the principal cause of deterioration of cellulose materials.

Moisture Content of Film

A most important characteristic of motion picture film is its susceptibility to moisture. Moisture has a definite effect on shrinkage, curl and buckle of film. Film in contact with dry air, or wrapped in dry paper, loses moisture; film in contact with damp air gains moisture. That is why controlled temperatures and humidity are so important since they protect and prevent rapid drying out of the film. Films should be stored so that dry bulb temperatures of 70-74 deg and a constant relative humidity between 50 to 60 percent are maintained the year around.

The moisture content of film is determined almost solely by the relative humidity of the air in which it is in equilibrium. The most important controlling factor in deciding the moisture content of photographic film (as well as paper, gelatin, and other related materials) is the *relative* humidity and not the *absolute* humidity of the air. This means that at 50 F and 60 percent relative humidity, for example, film holds more moisture than at 80 F and 40 percent relative humidity.

However, the moisture content of motion picture film is not entirely independent of the dry bulb temperature at constant relative humidity. Paper and cellulose acetate film hold slightly more moisture at lower temperatures when the relative humidity is constant. Nevertheless, in practice, the effect of a change in the dry bulb temperature at constant relative humidity on the equilibrium moisture content of film is negligible, compared with the effect of a change in relative humidity at constant temperature.

The difference in the moisture content of films and paper at any given relative humidity is due to the differences in their chemical composition and physical structure. Cellulose nitrate film contains less moisture than paper, which is a form of natural cellulose.

Mechanical Properties of Film

The effect of relative humidity and temperature on the mechanical properties of motion picture film is very important in practice. The effect of temperature at constant relative humidity on the mechanical properties of film is, usually, in the same direction as the effect of an increase in relative humidity at constant temperature. Heat, like moisture, makes the film soft and pliable. This in turn reduces the tensile strength. Film is therefore particularly susceptible to various distortions at higher temperatures.

It should be remembered, however, that an increase in temperature is generally accompanied by a decrease in relative humidity and vice versa, so that the effect of reduced moisture may partially compensate for the effect of heat.

Brittleness usually occurs at low relative humidities or at very low temperatures. Emulsion coated film

is more brittle than base alone because the emulsion itself is more brittle, which increases the chance of a break starting. The effect of subzero temperatures on the brittleness of film is interesting. Relative humidity has an important bearing on the brittleness of film even at temperatures below the freezing point of water. The moisture in the film does not apparently crystallize at these temperatures, but remains in a supercooled liquid state. This is probably the reason that more trouble from brittleness is not encountered in cold areas, where the outside relative humidity is usually high. Nevertheless, care should always be taken to prevent film from drying out prior to use at low temperatures. Additional precautions should be given to the handling of the film at either low relative humidities or low temperatures.

Curl and Buckle in Film

The tendency of motion picture film to curl is well known. The curl is *positive* when the film is bent toward the emulsion side, and *negative* when the film is bent away from the emulsion side. Motion picture film should usually have a slight positive curl. This reduces the possibility of scratching the film during handling. The curl of the film should not be too high at any relative humidity likely to be encountered in practice and should not change too much with age. This curl is ordinarily caused by shrinkage of the emulsion at low humidities.

When a film contains a sufficient amount of water or residual solvent and is wound tightly, and permitted to dry so rapidly that the moisture cannot diffuse from the center toward the edges as rapidly as it is taken away from the edges, then buckle is produced in the film. Buckle is the most serious type of film distortion, as it leaves a fullness of the center resulting in an "oil can" effect when the film passes through the projector, thus producing pictures that go in-and-out of focus on the screen.

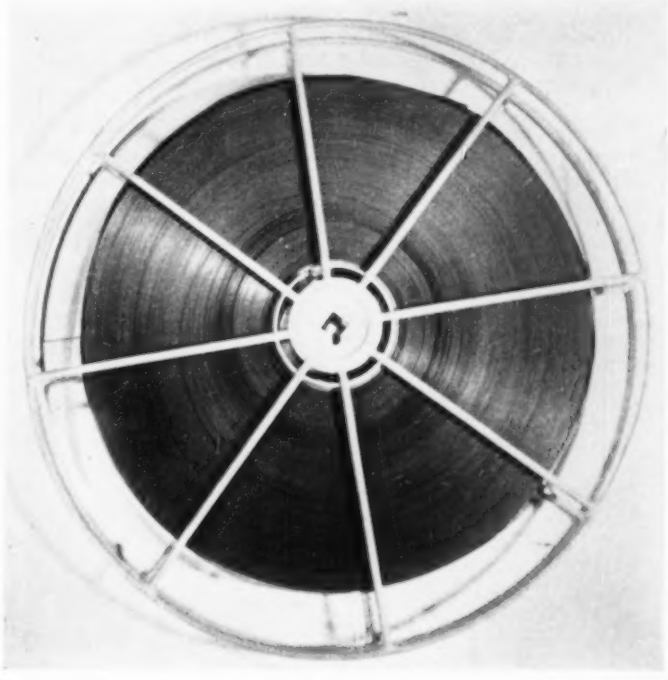
The use of cardboard boxes for shipping or storing film offers ideal conditions for the formation of buckle and curl. The film, often in equilibrium with 50 to 60 percent relative humidity, may be exposed to humidities as low as 10 to 15 percent due to the high moisture permeability of the cardboard. If the film, before being placed in plain cardboard containers, is wrapped in highly moisture-resistant paper this tendency to buckle and curl is virtually eliminated. New types of cardboard boxes, now available, in which a highly moisture-resistant layer is incorporated in the box itself probably do much toward protecting the film.

Curl characteristics of film tend to change in storage even where the moisture content of the film remains the same. The changes in curl are greater at high storage temperatures and low storage relative humidities. An increase in either storage relative humidity or storage temperature increases shrinkage of the base and accelerates curl changes due to this cause.

"Spokiness" in film occurs when a roll with a high degree of curl is wound with insufficient tension to keep the roll perfectly round. Spokiness is generally the result of overdrying in processing, resulting in film of high positive curl, and of loose winding, which allows film of high curl to spoke more rapidly. Spokiness also occurs when film which is not used over long periods of time is not rewound periodically.

After processing, film continues to shrink at a decreasing rate throughout the remainder of its life. The degree of permanent shrinkage which occurs depends on the type of film and the treatment it receives. As mentioned previously, film shrinks more rapidly at higher relative humidities. Consequently, where low shrinkage is desired, the film should be stored in tight rolls in well taped cans at low temperatures (50 F) and at moderate relative humidities (40 to 50 percent).

Although a storage relative humidity below 40 percent would be preferable from the point of view of reducing permanent shrinkage, this is not recommended because film tends to become brittle and curl becomes excessive at low relative humidities.



"Spokiness" in film occurs when a roll with a high degree of curl is wound with insufficient tension to keep the roll perfectly round. Spokiness also occurs when film which is not used over long periods of time is not rewound periodically. Shown here is a reel of slightly spoky film

Actual shrinkage of motion picture film during distribution and exhibition is of interest, due to the fact that film laboratory tests can never duplicate precisely the variety of conditions of storage and projection found in everyday use. Although new prints may be in equilibrium with an atmosphere of 70 percent relative humidity, after few bookings the film may be in equilibrium with air having a relative humidity of 30 percent. Measurements of this nature, therefore, include permanent shrinkage of the raw stock, processing shrinkage and shrinkage produced by subsequent storage.

Various tests have shown that 35 mm prints released to theaters for a year had a shrinkage of about 0.4 percent Safety 16 mm film showed a shrinkage of about 0.8 percent. However, the safety positive film was an older type and the presently available type shrinks much less under the same laboratory testing conditions.

The shrinkage encountered during exhibition varies considerably, depending upon actual projection and storage conditions in different parts of the country.

Dust Control and Storage

Precautions should be taken to insure that film storage vaults and film rooms are free of dust or dirt particles. These particles can do irreparable damage to film, such as building up static electricity on the film which, when discharged, could ignite the inflammable film. At a relative humidity of 50 to 60 percent, there are very few static charges built up. Although 16 mm film is noninflammable, specks of dirt or dust can scratch the picture and sound track of this film as well as 35 mm film, thus ruining it.

Rooms in motion picture studios where the 35 mm nitrate film is handled continuously are usually fireproof in construction, including the editing rooms, projection rooms and others. Although the handling of this film is minimized by closely connecting film storage vaults with the editing rooms and projection rooms, constant surveillance as to proper humidity is imperative for the prevention of static electricity.

The usual system of filing films in racks in film libraries or depositories is in the vertical position. One exception to this is the procedure of the National Archives which stores films horizontally. It is believed by them that such stacking takes the weight off the edge of the film and does not allow it to buckle as quickly as does vertical storage. Here again, in film libraries, films should be placed in humidor cans and stored in rooms that have a year 'round temperature of 70-74 deg and a relative humidity of 50 to 60 percent.

In conclusion, the proper performance of motion picture film in everyday usage depends to a great degree on the physical properties of the film and on how these properties are affected by relative humidity, temperature and other factors.

GIANT RADIATORS FOR BIG POWER PLANT

PICTURE A three-block-long bank of 120 giant automobile radiators —enough to cool all the engines in a bumper-to-bumper traffic jam more than 4½ miles long.

Each radiator is as tall as a street car. Each has a fan as large as a light airplane "prop". Each can get rid of heat enough to warm 22 average size homes on a winter day.

These comparisons give a rough idea of the huge cooling system built for the largest internal combustion power plant in the world—the new Point Comfort aluminum reduction works of the Aluminum Co. of America, at Port Lavaca, Texas. The plant can produce almost one-tenth the nation's annual aluminum ingot requirements.

The 120 huge radial internal combustion engines that drive the generators burn natural gas piped up to 30 miles from both off-shore and on-shore wells. Each engine will run on natural gas, diesel fuel, or a combination. Each has 1800 hp capacity, developing 1600 hp in normal operation. Each drives a 1000 kw direct current generator.

Scarcity of suitable cooling water made necessary a closed water cooling system, similar to that used in automobiles. Heart of the cooling system is the bank of 120 giant aluminum fluid coolers. Each unit stands 11½ ft high, 13 ft long and 9 ft deep. Each has a six bladed propeller fan 7 ft across. Each contains four cooling coils with separate cores for cooling engine jacket water and lubricating oil. Air is discharged into aluminum stacks, which also carry off the engine exhaust gases and the air used to cool the generators.

These giant coolers air cool the engine cooling water and lubricating oil for the engines in the world's largest internal combustion power plant (courtesy The Trane Co.)

Studies on

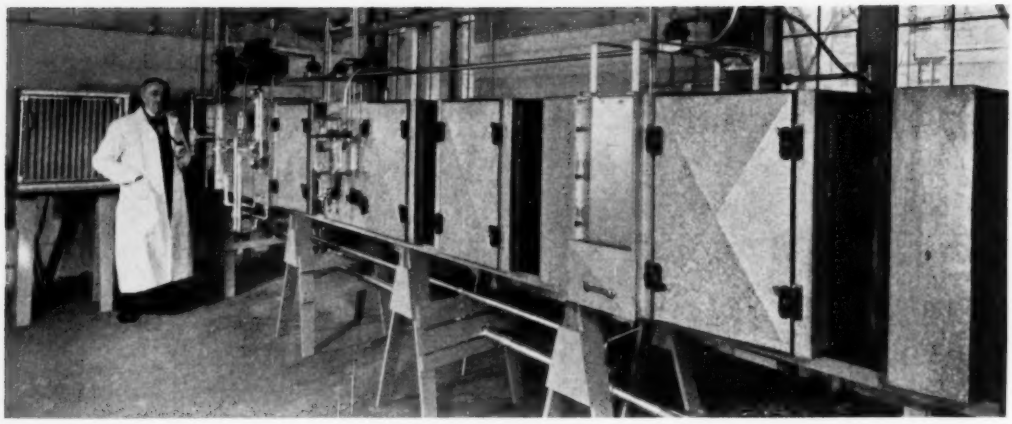
HEALTH AND AIR CONDITIONING

The Physical Environment Unit at the University of Illinois

M. K. FAHNESTOCK, research professor of mechanical engineering and engineering director of the physical environment unit at the University of Illinois, explains the background, organization and method of conducting research involving control of temperature, humidity, air motion, air pressure, etc., at the U. of I. . . . The importance of air conditioning to health becomes more apparent every day, and such studies as those at the University of Illinois indicate new applications for air conditioning, show the way on many fronts to a healthier life, as will be brought out in future articles scheduled for these pages

THE UNIVERSITY of Illinois consummated in 1918 a cooperative agreement with the National Warm-Air Heating and Ventilating Association (now the National Warm Air Heating and Air Conditioning Association) for a technical study of gravity warm air furnaces and gravity warm air heating systems. This was the first such agreement for investigation to be started by the university's engineering experiment station, which was founded in 1903 to stimulate engineering education; to investigate problems of special importance to professional engineers and to the manufacturing, railway, mining and other industrial interests of the state and of the country; and to train research workers. This agreement was the result of the initiative and foresight of Dr. Arthur Cutts Willard, now president emeritus of the University of Illinois. At that time he was professor of heating and ventilation in the department of mechanical engineering, and the investigation was set up in that department. The success of this cooperative program from its beginning resulted in its being largely the basis for the university's engineering experiment station policy for cooperative work with industry, technical societies, government agencies, etc.

By the early 1930's, under the stimulating leadership of Professor Willard and his associates, many technical problems concerned with establishing and maintaining desired temperature and humidity conditions in spaces occupied by human beings and animals had been studied in the department of mechanical engineering. About this time, the department of animal nutrition in the college of agriculture placed in operation a laboratory where large animals, such as cattle and hogs, could be studied under controlled conditions of temperature and humidity and the agronomy department was using a semi-portable shelter with mechanical refrigeration for controlling the



Research apparatus at the University of Illinois college of medicine, which includes filters, a fan, reheat coils, humidifiers, cooling coils and special condensing coils for studying the solubility of pollen protein in the water vapor in the air

temperature and humidity surrounding a number of hills of corn in experimental field plots. All of these, and other similar activities, were on the Urbana campus of the university.

Studies in the Professional Colleges

Concurrently, activities involving the control of atmospheric factors were developing in the university's professional colleges of medicine, dentistry, and pharmacy in Chicago, some 130 miles from the Urbana campus. Early in the 1930's, the departments of biochemistry and medicine, and the allergy group, were conducting extensive studies directed toward alleviating pollen asthma and hay fever through air filtration. Included in this program were some studies to determine the effect of air temperature and humidity on pollen asthmatics. Others on the Chicago campus of the university were concerned with the possible physiological effects of changes in barometric pressure, especially on critically ill people. No facilities were available for controlling pressure, so workers interested in the effects of this environmental factor had to confine their efforts to statistical studies gathered at random in the hospitals of the city at times when barometric pressure changes occurred during weather variations. It is needless to say that such work facilities were entirely unsatisfactory.

By 1935, comfort summer air conditioning installations involving control of air temperature, humidity and air motion had become sufficient in number in theaters, stores, restaurants, offices, hotels, trains, etc., so that, from day to day, a large proportion of the population of the country was being exposed to controlled conditions for varying periods of time and under different circumstances. Large numbers of adults and children of both sexes in various conditions of physical health were passing from hot, moist streets into comfort air conditioned spaces, and from the cooled spaces back into the streets. The criteria for properly conditioned spaces were based on the subjective reactions of normal human subjects after they had reached thermal equilibrium in test cubicles. Few objective data showing the physiological adjustments to rapid changes in environment were available. Rightly or wrongly, it was generally assumed that a comfortable environment was a healthy one.

Most of the subjective data available had been collected in the laboratory of the American Society of Heating and Ventilating Engineers. About this time, 1934-1935, certain outstanding members of the ASHVE became concerned with the lack of basic physiological information. A committee was set up with the directive to contact medical institutions for the purpose of initiating a Society sponsored cooperative research project to study objectively physiological adjustment of man to changes in the atmospheric factors of temperature and humidity under still air conditions. Late in 1935 this project was located in the university's college of medicine in the department of medicine, under the direction of Dr. Robert W. Keeton, M.D.

Like the warm air heating investigation which was started in the department of mechanical engineering in 1918, this physiological investigation is still active. Both investigations have produced and are still producing invaluable results, and both have served to attract and stimulate related activities.

College of Engineering Cooperates

In order to carry out the project which the department of medicine had undertaken, Dr. Keeton and his associates recognized that the physical facilities involved in controlling the environmental factors of temperature, humidity and air motion were engineering matters. Logically, they turned to the university's own college of engineering for help. Here an understanding, unselfish, and broadminded administrator, Dean Emeritus M. L. Enger, and persons in the department of mechanical engineering who had been concerned with the technical aspects of controlling temperature and humidity, both summer and winter, welcomed the opportunity to collaborate with the medical people.

In the college of engineering it had long been recognized that the end purpose of a central heating or cooling system serving spaces occupied by human beings was, first, to

create a healthy and comfortable environment. Secondly, it had been recognized that the determination of physiological adjustments and the interpretation of the adjustments were properly the responsibility of physiologists and medical doctors. Thirdly, it was recognized that a research team made up of physiologists, medical doctors, and engineers could proceed more rapidly, more efficiently and much more completely in solving problems involving man's adjustment to his physical environment.

Mechanical engineers were made available to work with the department of medicine on its physiological adjustments project, and with the department of biochemistry and the allergy group on their pollen hay fever and asthma work. Word of this engineering service spread rather rapidly and within months the department of mechanical engineering found itself involved in such matters as humidity control in operating rooms to alleviate explosion hazards; humidity control in children's wards in connection with the treatment of respiratory infections; special thermocouple systems for measuring the temperature of skin, bone marrow and gaseous anesthetics during administration; the control of air motion and cleanliness in experimental hospital rooms, operating rooms and premature infant cubicles; special exercising work apparatus for normal and impaired persons; apparatus for determining the specific gravity of human beings; chambers for use in the study of hyperoxic convulsions and gaseous treatment of mental disorders; psychomotor test apparatus; instruments for measuring and defining accurately the air temperature, humidity, air movement and radiation in various environments; and the control of odors in animal quarters, laboratories and hospital rooms.

All of these activities were in connection with established programs in a large medical school. In addition, there was an accumulation of programs involving the need for control of such factors as positive and negative pressures, vibration, sound, illumination and radiation. These had lagged because of the size, complexity and cost of the physical facilities required—not because of lack of staff.

Organization Committee Is Established

By 1940, excellent liaison had been established within the university between the colleges of agriculture, medicine, and engineering, and the departments of psychology and physiology and the school of physical education in the college of liberal arts and sciences. Similar liaison had been developed with government agencies, institutions, industries and organizations outside of the university. The importance of and the need for the accurate control of physical environment factors in precision work having to do with plant, animal and human life was recognized by key investigators in a number of departments and divisions and by the higher administrators. An organization committee composed of investigators, teachers and several administrators, all having some interest in atmospheric or physical environmental factors was set up. Dr. R. W. Keeton, M.D., was chairman of this committee.

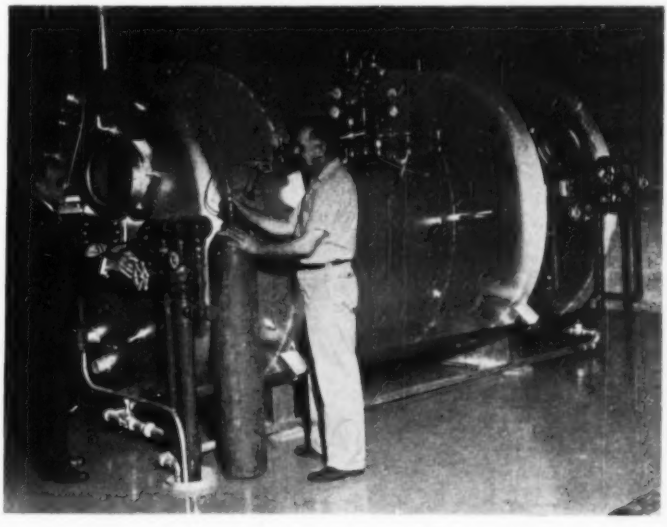
Following are some of the major matters which the committee has considered:

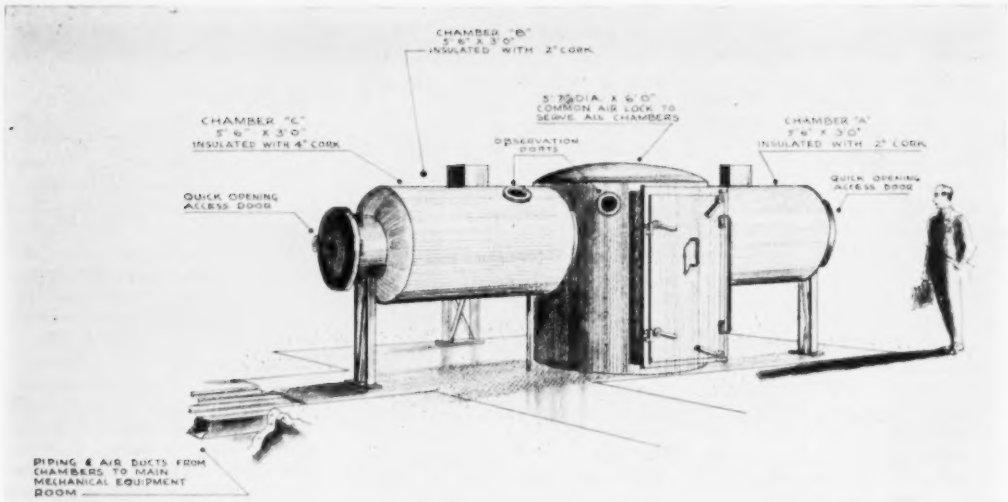
The importance of liaison and cooperation between the Chicago and Urbana campuses of the university—It was urged that individuals on both campuses, and especially those working in related fields, become acquainted with one another and with the work which each was doing—or hoped to do. In some instances, this resulted in investigators from the two campuses working together on problems of mutual interest.

The importance of liaison between the university and outside agencies—It was emphasized that there was probably no better way to broaden the perspectives of individuals than to have them learn the viewpoints of outstanding persons who, in other than academic institutions, were working in the same or related fields. The importance of such contacts in helping academic personnel to evaluate the real importance of some of their ideas was stressed.

The centralizing of physiological, medical and psychological activities involving environmental factors and human subjects—In the professional colleges in Chicago, individuals and departments were accustomed to working with both normal and impaired human beings. People of all ages and of both sexes were

A six-man pressure chamber (author on left) at the physical environment laboratory in Urbana, in which air pressure can be controlled over the range from atmospheric to 4.5 in. Hg absolute. Additional equipment is to be installed to control air temperature over the 50 to 120 F range and relative humidity from 40 to 80 percent throughout the range of pressure from atmospheric to 8.88 in. Hg absolute (equivalent to an altitude of 30,000 ft)





Proposed animal pressure chamber assembly for controlling air pressure, temperature, humidity and cleanliness

available for subjects. Complete hospitalization facilities, including laboratory and nursing services, were accessible. On account of these, it was logical to locate major activities involving human subjects on the Chicago campus. However, the need for some facilities on the Urbana campus for the use of the departments of psychology and physiology and of other divisions was not overlooked.

The fact that technical studies having to do with equipment for controlling environmental factors had been in progress in the college of engineering for a number of years—Those interested in the development of needed physical facilities appreciated that the design, building and operation of them should be done by engineers. These phases of the problem were, therefore, made the responsibility of the member of the department of mechanical engineering who had been assigned to liaison work in the colleges of agriculture and medicine for a number of years.

It had been stated previously that the original subjective data showing man's relative feeling of warmth, coldness and comfort when exposed to various conditions of temperature and humidity were gathered by engineers, and also that the ASHVE established a research project in the college of medicine in 1935 to obtain objective physiological data showing man's reaction to his environment. One of these engineers, E. P. Heckel, was unusually well qualified and experienced in process air conditioning, and conscientiously interested in the project and in the university. On a consulting basis he has rendered invaluable services during the past 12 years.

The fact that all plant, animal and human life is affected by physical environment—Many important activities in the university were concerned with various stages and forms of life which are influenced by environmental factors. This common denominator presented an unusual example of related major interests in separate administrative units.

"Service" Laboratory Provides Facilities

Limited apparatus for controlling environment were already operating in some departments. In many others, qualified personnel had waited for years for facilities to begin new studies or to extend old ones. When a number of the programs were collected and reviewed, it became obvious that it would be prohibitively costly to acquire and to operate the urgently needed facilities in individual units. Furthermore, much of the equipment was too heavy and too large to be placed in spaces which were already overcrowded.

Existing and projected programs and their requirements were summarized from the standpoints of animal or human subject work; long- or short-time experimental periods; and the environmental factors involved, including their range and permissible fluctuations. The precision control of wide ranges of temperature, humidity, air motion, air cleanliness, radiation, pressure, sound and vibration were needed. In order to provide for these needs, preliminary layouts of five major set-ups and a laboratory building were made and approved. The set-ups and building were as follows:

1) A rectangular pressure chamber two-bed hospital room.

2) A cylindrical pressure chamber one-bed hospital room.

3) An assembly of three small pressure chambers for work with animals.

4) A constant temperature, humidity and radiation room.

5) A quiet room.

6) A two-story building, approximately 50 ft by 150 ft.

The building was completed in 1948 and construction of the constant temperature, humidity and radiation room was started.

The advantages and disadvantages of having facilities on a university-wide service basis—Of prime importance to the success of any organization is the initiative of the workers and the opportunities for them to progress. Outstanding lab-

oratories and accomplishments are usually traceable to the vision, efforts and abilities of individuals. In replacing small separate laboratories with a larger service-type of laboratory, great care must be taken not to interfere with individual initiative and thinking, and to increase the opportunities rather than to curtail them. This can be done through proper administration and by having the service laboratory provide better and more facilities than would otherwise be possible.

The administration and operation of the unit—Established departments and divisions use the service facilities. They are administratively in charge of the scientific work and responsible for it. They provide the scientific staffs, special instruments and equipment adaptable only to their own work, and the necessary funds.

The major set-ups and basic instruments which can be used on programs of a number of departments are provided by the unit and operated by unit personnel. The maintenance of this type of equipment and of the general laboratory itself is also the responsibility of the unit. Service personnel are familiar with the apparatus and its operation, and a supervisor is available to advise department staffs as to what can be done with it.

The evaluation of the relative merits of proposed scientific programs, the assignment of the use of the facilities and the budgeting for the routine operation of the laboratory are the responsibility of an executive committee and an advisory committee. The vice president of the university in charge of the professional colleges is the chairman of the executive committee. The operation of the physical facilities of the unit on the Urbana campus is under a separate advisory committee and the budget is in the graduate college.

The Physical Environment Unit's Progress

The physical environment unit, as a division of the university, is now two years old. The groundwork and activities which eventually led to its formation extended over a period of many years. During that time the following progress was made:

1) The development of a philosophy of cooperation between individuals and departments, with each making his or its contribution toward a common objective.

2) The recognition of the potentials in a large university for group effort, by taking advantage of the capabilities of research teams made up of available specialists in the various sciences and professions.

3) In many instances, an appreciation of the contributions which different sciences and professions can each contribute toward the other was developed.

4) A pattern for carrying on interdepartment or horizontal activities in a university without interfering with its general vertical administrative organization plan was demonstrated.

5) A wide survey, covering the university and other institutions and organizations, was made to determine what had been done in controlling physical environment in connection with research, teaching and therapeutic programs involving human beings and animals.

6) The department of mechanical engineering summarized the needs for environment control and worked with the consulting engineer and the architects in completing the preliminary plans for the five major physical set-ups and the physical environment laboratory building.

7) The department of mechanical engineering built apparatus for studies in the departments of medicine, biochemistry, surgery, pharmacology, psychiatry, and animal nutrition, and actively cooperated with a number of them on research programs.

8) The department of mechanical engineering designed and supervised the construction of a small physical environment laboratory in the mechanical engineering power laboratory on the Urbana campus, including the installation of a small AAF indoctrination pressure chamber. The departments of psychology and physiology, the school of physical fitness, and the institute of aviation are now using this laboratory.

In general, it can be said that the facilities and the opportunities are being provided to stimulate new work heretofore never undertaken, largely on account of unavailable facilities; to improve the quality of work through precision selective control of variables; to take advantage of the potentials in a large university for major accomplishments through having specialists in the various sciences and professions work together; and to promote a better understanding between the sciences and professions and an appreciation of how each can aid the other.

[This article is based on a paper given before the 63rd annual convention of the Association of Land-Grant Colleges and Universities and unavailable elsewhere in published form.]

DEFINES ALUMINUM PLATE, SHEET

To CLARIFY the designation of aluminum sheet and plate, the sheet division of the Aluminum Association has adopted standard nomenclature for these products. The following definitions were adopted:

1) *Plate* is a solid section rolled to a thickness of 0.250 in. and heavier, in rectangular form with either sheared or sawed edges.

2) *Sheet* is a solid section rolled to a thickness range of 0.006 in. to 0.249 in. inclusive, supplied with sheared, slit or sawed edges.

a) *Flat Sheet* is furnished in rectangular form with sheared, slit or sawed edges, which may be flattened by any standard method.

b) *Coiled Sheet* is furnished in rolls (coils) with slit edges.

Heretofore, the terms "strip" and "coiled sheet" were applied interchangeably to the same product, but the new nomenclature officially recognizes the latter, more descriptive term.

BETTER CONSTRUCTION FORECASTS NEEDED

THE WIDE MARGIN by which building volume this year has exceeded advance estimates indicates a pressing need for more comprehensive studies by federal agencies engaged in analyzing and forecasting construction activity, James M. Ashley, president of the Producers' Council, national organization of building products manufacturers, stated last month.

"While private industry prefers not to lean unnecessarily on the federal government, legal and other obstacles prevent the building industry from developing the required information by itself," Mr. Ashley said.

New Pump Testing Laboratory Uses Up-To-Date Techniques

THE PROPER piping and other facilities in this new quarter-million dollar pump testing laboratory assure maximum accuracy of the test results. Occupying more than 7000 sq ft of floor area, a total of eight pump stations is included

MARKED BY MANY innovations in techniques and equipment to insure peak product quality and to guarantee matching or exceeding customer requirements for pump performance, the Peerless Pump Div. of the Food Machinery and Chemical Corp. has completed a new pump testing laboratory at Indianapolis. Finished last month, it involves over a quarter-million dollar investment, occupies over 7000 sq ft of floor area and includes a total of eight pump stations. Both high and low voltage equipment is available, making use of motors up to 1000 hp in size. It is designed for a capacity of over half a million gallons of water.

Pumps are tested to obtain their complete performance characteristics, to observe their operation and to compare laboratory results with calculated performance data. This requires measurement of the amount of water handled by the pump, the head against which the pump is operating, the power input to the pump and the exact speed of operation during measurements of the input and output factors. By conventional hydraulic formulas, efficiencies can be computed; and results with liquids other than water can be calculated if required. A pump laboratory requires a large water supply so that accurate test readings can be obtained without air being entrained in the water and to avoid overheating of the water due to recirculation.

To provide ample water for testing several units at the same time and to give sufficient volume for large capacity pumps, there is a test pit 30 ft wide by 192 ft long and 12 ft deep. At one end of this rectangular pit, a round pit 10 ft in diameter and 40 ft deep makes it possible to test vertical pumps. A dividing wall in the center of the large pit permits drainage of half of the pit for cleaning without disrupting testing in the other half, as well as for possible calibration of large meters by displacement. Based on 20 percent recirculation of water, the pit is of ample size to test pumps up to 86,000 gpm capacity.

Accuracy in Pump Testing

There are several refinements in the hydraulic apparatus for accuracy in pump testing. For example, venturi meters insure accurate measurements of capacities within ½ percent. Mercury manometers with scales calibrated directly in gpm for each size venturi tube guarantee maximum accuracy in capacity measurements and reduce the time required to make each test.

Each discharge pipe assembly has a straight piece of pipe of at least 10 pipe diameters (more on the smaller sizes) between pump nozzle and venturi meter. In addition, each discharge pipe contains a pair of straightening vanes three times the pipe diameter in length and welded in the pipe 12 in. above the venturi meter. The smaller venturi meters, 12 in. and below, are arranged for manifolding in pairs, and these pipe assemblies have an additional honeycomb type straightening section of at least one pipe length installed at the upper end, joining the manifold. By using these straightening devices and a long straight run of pipe prior to entrance into the venturi section, much more accurate readings of capacity can be made in the laboratory than is normally possible in a field test with its limitations due to piping restrictions and turbulence due to fittings and insufficient length of straight pipe before a measuring device.

Head measurements up to 100 ft can be made with a mercury column calibrated in feet of water to facilitate calculations and eliminate errors. Beyond 100 ft head, calibrated bourdon tube gages are used to measure the discharge pressure in pounds per square inch up to any pressure required. These are regularly checked on a deadweight gage tester. Mercury manometers are used on the suction side of the horizontal pumps to obtain direct readings of the suction lift. From these suction lift readings and discharge heads and any necessary correction for velocity head, the total head of the pump is easily computed.

The Dynamometer Equipment

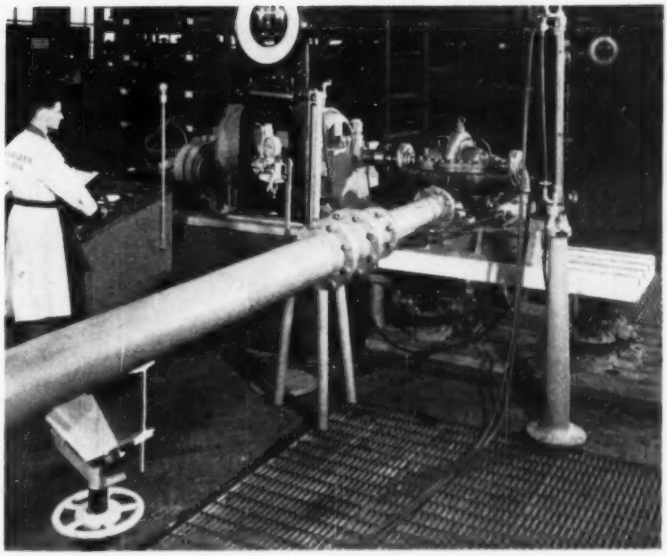
One of the outstanding features of the new laboratory is the extremely accurate horizontal cradle

mounted dynamometer equipment. These direct current dynamometers are controlled by amplidynes with electronic pre-amplifiers, and this installation is said to be the first hydraulic pump laboratory in America to use this type of control. Since centrifugal pump capacity varies directly as the speed, the head as the square of the speed and the horsepower as the cube of the speed, even small speed fluctuations during a test greatly increase the errors in capacity, head and horsepower readings.

The switchgear and motor-generator equipment is housed in a separate enclosed fireproof, dustproof room. The motor-generator sets are designed to produce d-c power for the dynamometers which are electronically controlled in conjunction with amplidynes for constant and accurate speed control. Briefly, this regulating system consists of a small alnico generator direct connected to the dynamometer which puts out a voltage signal directly proportional to motor or pump speed. This signal is fed into an electronic pre-amplifier, which regulates the voltage on an amplidyne generator controlling the main generator field, thus regulating dynamometer speed by controlling the main generator voltage.

With this equipment it is possible to set any desired speed at the dynamometer control desk and make head, capacity and horsepower readings at this given speed without further adjustment of any controls on the generator or the d-c driver. Since the speed is held constant by automatic devices, the capacity is read directly in gpm and the head is read either in feet of water or is easily computed from pressure gage readings, no further calculations are necessary. Thus it is possible to observe immediately all the operating characteristics of the pump under test. In addition to this ease of testing, the fact that practically no fluctuations of the operating speed exist results in high accuracy.

At each dynamometer station there is a master control desk from which the test engineer can start and stop the machines and adjust the speed. Also, as part of the control desk, there is electric chronotachometer equipment which includes an approximate rpm meter, a high accuracy revolution counter and an electric timer, which enables the recording of average pump speed over a period of time to very close values. With this highly accurate rpm reading and the dynamometer torque reading, the horsepower can easily be figured and assures an accurate calculation of the efficiency of the pumping unit.



A technician taking test readings on a general purpose horizontal centrifugal split case pump at a typical pump test station in the new laboratory

NWAHACA APPROVES FIELD STUDY

AN EXPANDED field investigation program was approved by the National Warm Air Heating and Air Conditioning Association's semi-annual board of trustees' meeting. The program will include a mobile laboratory with a full-time investigation engineer to conduct continuous testing of heating systems already installed throughout the country. It will supplement the association's research program at the University of Illinois.

NYU OFFERS SANITARY AIR COURSE

THE GRADUATE division of the New York University college of engineering will institute a new course called Sanitary Air Analysis during the second term of the 1950-51 academic year which will include lectures, readings and reports and will cover theory and practice concerning the detection and engineering control of atmospheric pollution. Study will also be made of the properties of air, air sampling, ventilation measurements, methods of detecting and controlling dusts, solvents, vapors, gases, and other atmospheric contaminants. In addition, radiation, noise and illumination will be given attention.

PHOTOGRAPHS AIR FLOW PHENOMENA

A NEW INSTRUMENT designed to facilitate observation and photography of air flow phenomena, known as the Schlieren light source, is a self-contained unit housing power supply, control circuits, lamps and optical system. It operates on the principle that a change in air pressure or temperature produces a change in the air's light bending properties. (Like the familiar shimmer of air above a heated road in the summertime.)

Developed by the General Electric Co., the ultimate purpose of the equipment is to reveal graphically the air flow patterns around high speed missiles and models of supersonic aircraft in wind tunnels.

District Heating Industry Reports Air Conditioning, Other Progress

By John F. Collins, Jr., Secretary-Treasurer, National District Heating Association

THE PROGRAM of the commercial relations committee at the 41st annual meeting of the National District Heating Association, held recently at Asheville, N. C., was opened by J. R. Vernon, sales promotion manager of the Johnson Service Co., who discussed "district heating's most pressing commercial relations problems." Mr. Vernon said that the comparative smallness of the industry made it unprofitable to seek good relations by approaching the general public directly. He felt, however, that efforts should be made with all levels of government to advance the standing of the industry. He said efforts should be made to have good relations with both employees and stockholders, since both of these groups contact others and can be either a help or a hindrance to the organization.

The greatest effort, he said, should be put forth to impress favorably existing and prospective customers. He proposed that this be done by rendering special services courteously and promptly, by urging the necessity of proper maintenance, by working to keep bills down and by explaining the reasons for charges that may appear high. He summed it all up as "human engineering."

A more accurate method of estimating heating requirements was discussed by James S. Locke, of the Minneapolis-Honeywell Regulator Co. He outlined the factors affecting heating load, which he said were structure, environment and weather (including wind and solar radiation). He said that the degree-day basis is not reliable except over long periods of time. He proposed as an improvement the use of a "heating analogue" to be made to respond to all the weather conditions. Ennis Jones was the co-author of the paper.

Robert Y. Sigworth, supervisor of utilities, Pennsylvania State College, whose district heating system serves 117 buildings, presented a comparison between the actual and calculated hot water demands at his institution. He outlined the effect of instantaneous heaters and of the use of temperature controls on steam demand.

Turning Steam Off at Night

How to accomplish the greatest overall economy in the use of steam, with consideration of the problems of the utility as well as of the customer, was reported on by Carl B. Sprenger, of The Detroit Edison Co. Mr. Sprenger said that the mildness of the last winter had prevented wholly satisfactory tests on buildings to find the peak demands and yearly consumptions when steam was turned off at night and when allowed to continue through the night under daytime conditions of control.

On a particular building, the *demand* was 6300 lb when steam was on 24 hr and 8400 lb when off at night. Turning off at night resulted in a reduction in *consumption* of 33 percent but an increase in *demand* of 2100 lb. An increase in demand is important in that it uses up a utility's capacity, necessitating a larger investment, higher fixed charges and a higher rate. The question is by what means is most accomplished. A further report was promised for a future meeting.

A series of sketches on installations were presented to close the committee program.

Percy A. Hyde, Ohio Edison Co., described heating system and service changes in a quarter-century at an Akron department store where year 'round air conditioning is now in use. He also told of the installation of eight shunt meters in a series of storerooms whose condensate returns to a single vacuum pump.

F. Lee Rapson, Consolidated Gas Electric Light and Power Company of Baltimore, reported on the replacement of old heating apparatus with modern heating equipment in several buildings about the country.

Mr. Sprenger presented a complete picture of the changes and costs involved in supplying steam and electric service to the 24 yr old Masonic Temple in Detroit. The total estimated annual saving was $15,000, the cost of steam system changes $35,000, the cost of electric system changes $5000 and the actual steam consumption 36 percent below the estimate on a degree-day basis.

Sales Development Committee Chairman Charles W. Deeg, of the Philadelphia Electric Co., opened his committee's program by presenting a paper describing the functioning of the new industrial and commercial development division of his company in retaining industries using electricity and steam now located in the area, encouraging them to expand there, and inducing new organizations to locate facilities within the boundaries of the company's system.

The growth of summer air conditioning connected to the lines of the New York Steam Corp. from 1930 to the present 47 installations, totaling 24,000 tons, was described in a paper by R. E. Burke of that company, presented in his absence by Howard W. Harrison, of the Georgia Power Co. Mr. Burke's curves showed a rapid rise in installations since 1944 and in air

conditioning tonnage since 1948.

Chairman Deeg had as guest speaker on his program T. N. Asbury, Jr., director of sales, of the Charles S. Martin Distributing Co., Atlanta, on the subject "How to Get a Man to Do a Job." Mr. Asbury gave excellent advice on the necessity of not only carefully selecting a man for a job and training him for superior performance in it but also on the importance of carefully supervising him.

Steam Absorption Units for Air Conditioning

One of two new NDHA committees, the air conditioning committee, with Robert D. Martin, New York Steam Corp., as chairman, made a report consisting of two papers and an address.

Wirt Scott, Philadelphia Electric Co., presented an analysis of the estimated owning and operating cost of an absorption system of air conditioning for 287 guest rooms at the Warwick hotel, Philadephia, and compared these data with similar estimated costs for a mechanical system. The annual costs were found slightly in favor of the absorption system.

A 150 ton steam absorption air conditioning machine was installed in the general office building of the Consolidated Edison Co. in New York City in 1947, and has been in use during each air conditioning season since. R. A. Lammers told of the operating experience. He described the building, the machine, the system and the load. Mr. Lammers found the cost of operating the entire system for a summer to be $5299, or for the machine only for a summer, $3100.

Guest speaker on the program was Alfred L. Jaros, Jr., of Jaros, Baum & Bolles, New York consultants for many of the largest recently constructed buildings. Mr. Jaros spoke in part on the new Massachusetts Mutual Life Insurance Co. building, New York, and in part on steam absorption refrigeration in general.

He said the new building will have "the largest steam absorption system installed to date" (1100 tons). It will be placed (with the exception of the water pumps in the basement) at the top of the building, freeing two basement floors for rental purposes. The ability to use the top floor for the equipment was a factor in its selection. Another was the fact that the steam absorption equipment operates economically on low loads.

Mr. Jaros said that low pressure steam can be used in the absorption equipment with little penalty as to steam quantity, but that the purchase price is higher, which resulted in their selection of equipment to use steam at 60 psi.

Several Reports on Metering

The NDHA metering committee, being of the opinion that the present range of flow metering accuracy can be increased only by the introduction of a compound meter, produced during the year tentative specifications for such a meter, which were described by Chairman William G. Gillim, of New York Steam Corporation, at the meeting.

In their paper on results of testing shunt flow meters by air, P. A. Hyde and C. D. Zimmerman, both of the Ohio Edison Co., explained the practical use of the equipment in testing shunt flow meters by air and the results obtained.

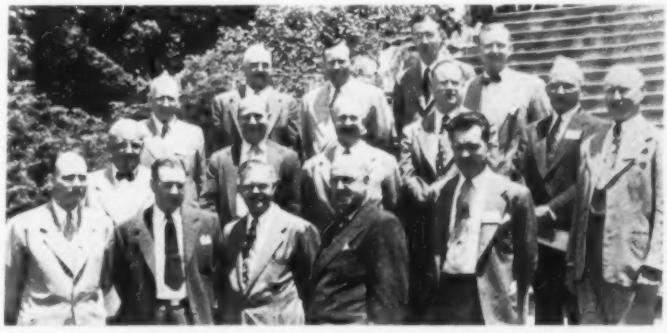
An electrically-operated average pressure meter, a recent development of the New York Steam Corp., was reported by Walter Wisschusen of that company. Mr. Wisschusen said the meter eliminates the use of the chart, the spring-wound clock, the ink pen and the planimeter. With this meter it is not necessary to make readings at fixed time intervals. The cost installed is approximately $550.

J. C. Thompson, Georgia Power Co., in his paper on a method of consolidating demands of condensate meters, described a novel cam-operated, microswitch mechanism which can be attached to a meter counter. Impulses can then be transmitted to a totalizer for totaling the demands of any number of such meters.

In his paper on standardization of meters, metering and testing, Mr. Gillim reported on how the metering of steam service can be improved. He pointed out that the electric and steam utilities, by cooperating with meter manufacturers, have secured accurate and inexpensive meters, and advised that standardization of meters, metering and testing is needed in the district heating industry.

The step by step procedure and an example of the use of block analyses as an effective tool in designing block rates and determining block rate effects of proposed rate changes were given in a paper prepared by H. A. Weitzman, of the Rochester (N.Y.) Gas and Electric Corp., which in his absence was presented by Rates and Regulations Committee Chairman C. O. Thurlow, Commonwealth Services, Inc., Jackson, Mich.

In the final paper on the committee program, George Morrison, New York Steam Corp., described the



Officers, executive board and committee chairmen of the NHDA for 1950-51. *Front row, left to right:* George H. Tuttle, president; Alfred T. Veness, first vice president; Charles W. Deeg, third vice president; and Percy A. Hyde, second vice president. *Middle row:* Harold W. Coombs; John F. Collins, Jr., secretary-treasurer; Fred W. Deutsch; Arthur T. Lukens; Thomas P. Brown, Jr.; F. Lee Rapson; John N. Voorhees; and George K. Saurwein. *Back row:* E. E. Dubry; Clifford O. Thurlow; William G. Gillim; and Roy M. McQuitty. David W. Loucks, Robert D. Martin, George F. Prestwich, J. Earl Seiter, Foster L. Stephens, Robert L. Fitzgerald, Arthur S. Griswold, Howard W. Harrison, and Lee C. Killen were absent when photo was taken

preparation of an annual rate analysis for his company, which allocates operating expenses and ascertains for each classification the rate of return earned on the rate base assigned to each group of consumers.

Economical Insulation Thickness Increases

Steam losses are always of interest to the steam utilities. The chairman of the steam losses committee, Glen D. Winans, of The Detroit Edison Co., reported on a number of sources of such losses. One large one is the natural heat loss from the distribution piping. The amount that this loss can be reduced is limited by the amount of insulation that can be economically applied. E. T. Smith, also of Detroit Edison, in his paper on economical thickness of insulation on underground steam mains, pointed out that a satisfactory thickness 20 years ago would be considered inadequate today because of the increased cost of fuel, labor and materials. If the trends of the past are to extend into the future, we should insulate well, he said.

A paper by W. M. Gillespie, of the Dayton Power and Light Co., was the first of several on the program of the steam station engineering committee, of which G. F. Prestwich, Philadelphia Electric Co., is chairman.

Mr. Gillespie reported the results of tests to show the actual temperatures reached by underfeed stoker iron under various conditions of boiler operations. The maximum shown on the chart of the tests was 1350 F.

R. C. Hine, Consolidated Gas Electric Light and Power Company of Baltimore, under the title Low Cost Capacity in Operation at Baltimore, described a type of installation which, it is believed, has provided the needed generators at a minimum annual expense to the Baltimore company. As the result of a study, it was decided to install three standardized oil fired units, each having a capacity of 60,000 lb per hr. It was agreed that the high standards prevailing in electric power station design, made necessary by the demand for uninterrupted service, could not be justified in this installation. The boiler was only partially enclosed. It is believed that the average cost per lb of gross output for the ultimate development will be $2.70 compared with $8.85 per lb of gross output for the conventional 150,000 lb per hr installation.

Final Session on Distribution Systems

The entire final technical session was given over to the large program prepared by the distribution committee, of which George K. Saurwein, Negea Service Corp., Cambridge, Mass., is chairman. Seven papers on distribution subjects were presented.

John C. Haroldson, Duluth Steam Corp., described the 8 in., 150 psi steam line installed in his city in 1949. The line consists of 2344 ft of 8 in. extra heavy pipe covered with 3 in. of glass foam insulation, all in concrete envelope. Sixteen corrugated, packless type expansion joints provide for expansion.

The district heating system of the Toledo Edison Co., which was started in 1930, has been greatly expanded in recent years. Irvin H. Heitkamp, of that company, described the original system, the various additions and its present extent. There is now over five miles of pipe.

In Denver, a 14 and 16 in. steam transmission line 1½ miles long was recently installed to provide a new source of steam for the downtown distribution system. R. F. Throne, Public Service Company of Colorado, prepared a paper on the subject, which in his absence was presented by J. L. McKinley of the same organization. The line was laid in patented prefabricated conduit with precast manholes. Twenty-eight slip type joints were used.

The complete-in-place cost of manholes decreased from $813 at the start to $550. The estimated saving over the standard type manhole was $100 each. There are three sources of steam at the plant, (1) from the 9th stage of the 35 kw turbine; (2) from the 1st stage and (3) from the boiler header. Including reinforcing lines in the distribution system, 13,162 ft of line was installed at a total cost of $43.50 per ft.

How to Reduce Steam Line Cost

Everett C. Russell, Philadelphia Electric Co., reported on his investigation of ways to reduce steam line construction cost. His information was gathered from 15 steam utilities. Among the suggestions he offered were:

1) Use mechanical equipment in construction.
2) Use insulating concrete.
3) Use prefabricated lines.
4) Use preformed conduit.
5) Eliminate drain tiles.
6) Weld and insulate lines above ground.
7) Change type of expansion joint.
8) Use precast manholes.
9) Do as much welding as possible.
10) Use preformed sectional insulation.
11) Place lines in excavated areas.
12) Make small service lines of copper.
13) Increase insulation thickness.

Soil temperatures adjacent to underground steam lines is a subject of interest to heating utilities. For several years Vernon J. Suche, Union Electric Company of Missouri, St. Louis, has been investigating such conditions. At the Asheville meeting he reported temperatures adjacent to a 4 in. steam line insulated with insulating concrete and a 6 in. line insulated with fiberglass in conduit.

Alex Douglas, Cleveland Electric Illuminating Co., and Foster L. Stephens, Allegheny County Steam Heating Co., Pittsburgh, reported the results of their inquiries to 15 companies as to pressure regulating practice. Subjects covered were normal pressure, safety devices, methods of pressure reduction, stages of pressure reduction, condensation in mains, series installation of pressure reducing valves, methods of control, maintenance improvements in practice, preferred valve materials and preferred makes.

A report of similar nature on slip type expansion joints was made by E. T. Smith and W. D. McCully, both of The Detroit Edison Co. Their paper included such information as variety of practice and materials, method of anchorage, maintenance and the more common troubles.

[This concludes HPAC's report of this convention. The first part was published in the August issue].

What's Relation of Sag, V Belt Length?

*By F. H. Rumble**

NEWLY INSTALLED sets of V belts that sag—some more noticeably than others—very often pose the question: "Will pulling the sagging belts tight overstretch the others?"

Actually, a sagging belt is no cause for anxiety. Too often the relation between sag and belt length is misunderstood. This leads to an exaggerated idea of the difference in length between V belts on a multiple belt drive.

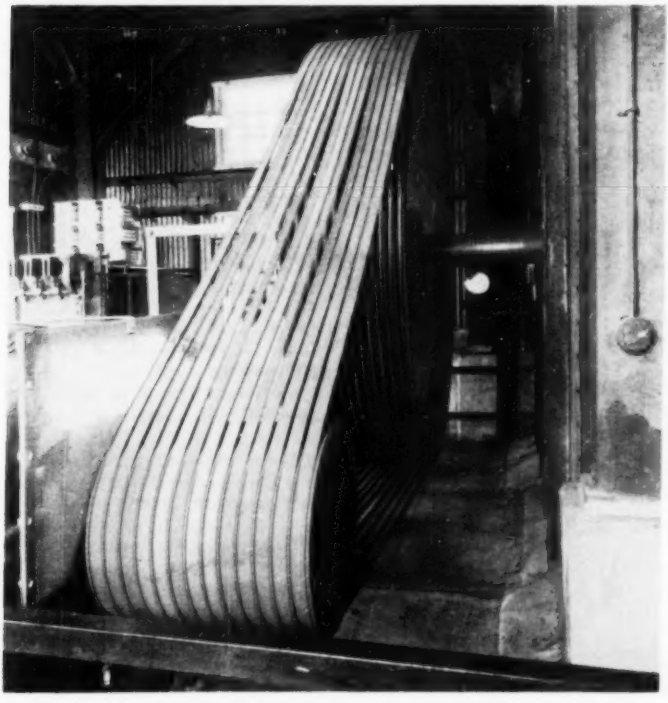
To clarify this situation, it should be pointed out that measurements of V belts are made on grooved sheaves in motion under normal operating tension. Each belt is stamped, following the name brand, with an inspection number. This number is used to represent the plus or minus tolerance of the belt.

Let us, for example, say that 50 has been selected as the base number. Then, belts stamped with numbers below 50 are minus tolerances; those identified with numbers over 50 are plus tolerances. Each number represents a difference of $\frac{1}{10}$th in. The maximum length difference allowed between the shortest and longest belt in a matched set is only $\frac{1}{10}$th of an in. per 100 in., or $\frac{1}{10}$th of 1 percent. Consequently, stretching the shortest belt of a set this small amount will not harm it. [Some manufacturers employ fractional differences of $\frac{1}{16}$th instead of $\frac{1}{10}$th in., and in one instance a lettering system of identification is employed instead of numerical].

Takeup table for V belts (in inches)

Centers in inches	Sag (in inches)						
	½	1	2	3	4	5	6
20	0.037	0.130	0.513	1.08	....	....	....
30	0.025	0.095	0.343	0.78	1.51	....	....
40	0.010	0.074	0.240	0.59	1.03	1.61	....
50	0.008	0.028	0.20	0.44	0.83	1.27	1.86
75	0.004	0.018	0.17	0.30	0.60	0.87	1.25
100	....	0.025	0.054	0.12	0.40	0.66	0.94
200	....	....	0.03	0.06	0.21	0.37	0.42
300	....	....	....	0.035	0.16	0.29	0.35

A fraction of an inch takeup is all that would be necessary to bring these 13 V belts driving a mine ventilating fan into line



In considering the length between the tangent points of the sheaves on a drive, the accompanying table gives the differential in length between a belt which is tight and one which sags on the same drive. Values listed are for 180 deg arc of contact on both sheaves and would vary slightly for other ratios.

Any reference by an operator to belts being "four or five inches longer than other belts on the drive" is usually exaggeration based on a misunderstanding of the relation between sag and belt length. Actually the amount of sag is very misleading, as can be seen by the table. On a center distance of 100 in., a sag of 2 in. will appear to be very drastic but it can be removed by only 0.054 in. of takeup on the motor base— less than $\frac{1}{16}$ in.

Consideration should be given to apparent differences in belt length on V belt drives caused by sheave grooves which have worn down unequally. Where such a situation exists, regrooving the sheaves or replacing them with new ones would be the most economical procedure.

*Texrope Drive Dept., Allis-Chalmers Mfg. Co.

Modernization With Piping Ups Production Efficiency

PIPING is industry's greatest transportation system, a specific example being the extensive installation at the Tousey Varnish Co. Modernization of the plant production facilities with new piping, pumps and tanks has resulted in some 17 advantages, which range all the way from eliminating hazards to decreasing the costs of raw materials. Plants in many types of industries offer similar opportunities for improving production and reducing hazards through installation of the right piping facilities

BEFORE INSTALLATION of the new "materials handling" piping system at the Tousey Varnish Co., Chicago, the pipe and pump sizes of course had to be selected. These are determined by the speed of handling and the characteristics of the liquids pumped.

Tousey uses a minimum of 10,000 gal per day of raw materials, and ships out the same amount of finished product. Using this as a basic quantity, and allowing time for pumping, mixing, processing and manufacturing, 50 gpm pumps were decided upon.

While there are at least three types of pumps that could have been used, reciprocating pumps were actually installed after careful consideration of their advantages and disadvantages. The advantages are:

1) Simple operation.
2) Resist wear due to handling abrasive materials.
3) Handle small quantities at high head pressure.
4) Discharge directly proportional to pump speed.
5) Can change speed with little change in efficiency.
6) Control simple and easy.
7) Rate of discharge constant regardless of change in head pressure.
8) Handle oils of high viscosity at all temperatures with little change in efficiency.
9) Greater suction lift than centrifugal pumps.

The disadvantages were listed as:

1) Slow speed.
2) Small capacity.
3) Extreme size and weight for handling moderately large quantities.
4) Pulsating discharge.
5) Low efficiency under conditions of operation.
6) Positive displacement action, which makes throttling or closing of discharge valves hazardous while pump is in operation, even though bypass relief valves are provided.

After the type of pump was selected, the type of driver was considered. This choice was based on the type of power to be used, the service required, the characteristics of the materials to be pumped, the rate of discharge and the maximum pumping head.

To measure viscosity in a paint and varnish laboratory, the material to be tested is placed in a sealed tube and the time for the bubble to ascend in the inverted tube is compared with a standard tube of known viscosity

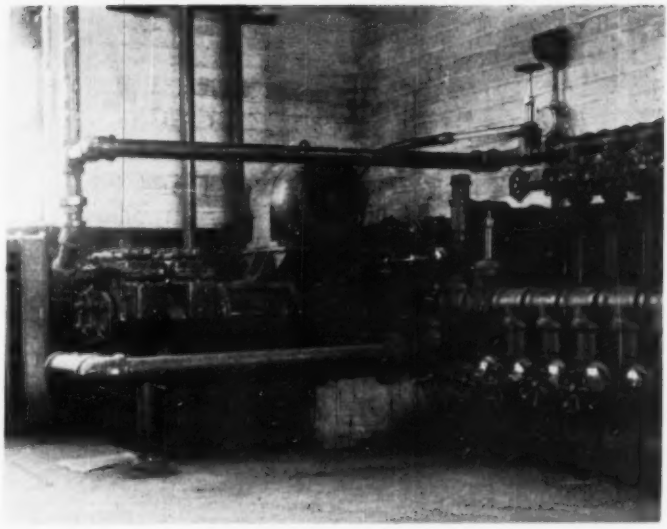
In selecting the type of power, the following factors were considered:

1) Cost of an electric power unit and its installation.
2) Cost of operation and maintenance of an electric power unit.
3) Cost of diesel equipment and its installation.
4) Cost of operation and maintenance of diesel equipment.
5) Cost of boilers and equipment to generate steam and conduct it to the pumps.
6) Cost of installation, operation and maintenance of steam equipment.
7) Availability of electricity from utility company.
8) Choice of current characteristics of electricity from utility company.
9) Reliability of electric service from utility company.
10) Demand or minimum monthly charge by utility company.
11) Average yearly cost for electricity from utility company.

Electric motors were installed at Tousey to drive the pumps. Electricity is obtained from the local utility.

The size of the motors depends

The pumping and piping system at the Tousey Varnish Co. has improved production efficiency and has resulted in a number of advantages, including a reduction in employee accidents



on the rate of flow, type of flow in the piping, resistance to flow caused by pipe walls and fittings, height of maximum suction lift, height of maximum discharge head, specific gravity of the materials pumped and viscosities of the liquids handled.

The rate of flow had already been determined—50 gpm. This would remain constant with reciprocating pumps, or it could be varied by changing the speed of the pump, or by changing the size of the plunger. However, 50 gpm was used for the design calculations.

Suction Lifts and Discharge Heads

The height of the maximum static suction lift was known because it is the distance from the bottom of the underground storage tanks to the center line of the pump shaft.

The maximum static discharge head is the distance from the center line of the pump shaft to the liquid level in the second floor tanks. Since the discharge pipes enter the bottom of these tanks, the pumps have to operate against varying static heads as the tanks fill. However, the static discharge head was calculated as the highest liquid level in the tanks.

The static suction lift and the static discharge head combine into the total static head. It is the vertical distance from the surface of supply to the free surface of the liquid in the discharge tank or to the point of free discharge in the discharge piping. In the Tousey installation, both the suction and discharge are under atmospheric pressure and the total static head is merely a difference of elevation.

The static head refers to conditions when the pumps and liquid are at rest. When the pumps are operating, and the liquid moving, there are dynamic conditions to be taken into consideration.

For example, the static suction head is the vertical distance between the liquid level of the second floor tanks and the pump shaft center line. If this is less than the friction of pipe, elbows, valves and other fittings when the pump is working at full capacity, there is a dynamic suction lift.

The dynamic discharge head consists of the static discharge head plus the head necessary to move the liquid in the discharge line. The total dynamic head consists of the sum of the dynamic suction lift plus the dynamic discharge head. If there is a dynamic suction head, the total dynamic head is the dynamic discharge head minus the dynamic suction head.

Velocity head is one of the elements making up the total dynamic head, but the value is usually so small that it can be disregarded. It should be taken into account, however, when the total head is low and the suction lift is high.

When the suction and discharge pipes are the same diameter, it is only necessary to include the velocity head generated in the suction pipe. If the discharge pipe is smaller than the suction pipe, it is necessary to include the velocity head developed in the discharge pipe.

At Tousey, liquids are pumped in both directions in all pipes, so they are both suction and discharge lines. However, the suction lift is not high although there was difficulty pumping at one time because long suction hoses were used to pump heavy bodied liquids. This is described later.

Another factor to be considered is the friction head. This is the force absorbed in a liquid in motion. Friction is among its own particles, and along the pipe walls. Friction head varies with the character of the liquid being pumped, and the condition of the pipe.

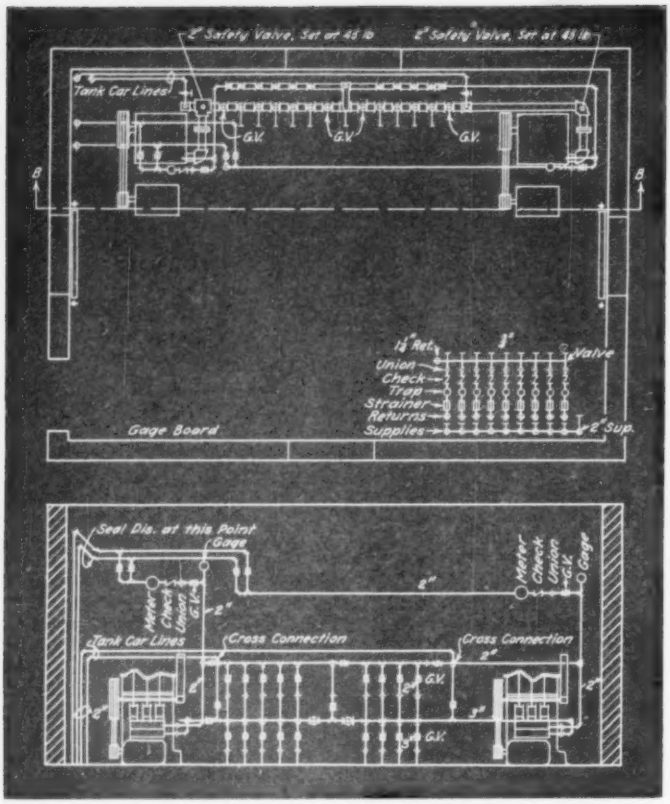
Tousey uses both thin and heavy bodied liquids. The thin liquids are difficult to hold—they leak through the tiniest openings. For this reason, Dougherty Bros., the piping contractors, used long tapered threads, and welded the suction and fill lines. Extra heavy couplings and fittings were used.

The heavy bodied liquids are more difficult to pump because they offer more resistance to flow. In other words, they are very viscous. This is because there is cohesion between the particles, resisting any sliding motion. This property is the cause of all so-called "fluid friction."

Viscosity in Paint and Varnish Industry

Viscosity is measured in the paint and varnish industry by the Gardner-Holdt scale, which resulted from experimental work carried on by Gardner and Holdt in a laboratory of the National Bureau of Standards and in the laboratories of the Institute of Paint and Varnish Research at Washington.

The Gardner-Holdt scale is graduated according to letters of the alphabet. The "A" end of the scale refers to liquids having great fluidity at room temperatures. Solvents are classed at this end of the scale.



Plan (above) and section "B-B" (below) showing motor driven pumps, headers and piping in one of the Tousey pump houses

Spar varnishes are included in the "E" and "F" portions of the scale. The "Z" end of the scale refers to liquids that offer considerable resistance to flow. It is at this end of the scale that numbers are combined with the alphabetical letter to give further differentiation.

For example, the most viscous materials used by Tousey range from "Z-1" to "Z-5." To measure this, a paint and varnish laboratory has a set of glass tubes exactly 100 mm (approximately 4 in.) long with an internal diameter of 10.7 mm.

The tubes are filled with just enough liquid to leave a bubble of air longer than it is wide. Each tube has a different viscosity liquid.

The material to be tested is placed in an identical tube, bubble room left, and both ends of the tube are sealed. Then the trial tube and a standard tube are brought to the same temperature (25 C or 77 F) in a water bath.

To make the test, both tubes are inverted simultaneously. If the bubbles ascend at the same rate of speed, the viscosity of the sample is known. Otherwise, another standard tube is tried, and so on until the right one is found.

To give an idea of the viscosity of liquids ranging from "Z-1" to "Z-5" on the Gardner-Holdt scale, the following table has been devised.

"Z — 1"—43.6 sec for the bubble to ascend.
"Z — 2"—51.0 sec for the bubble to ascend.
"Z — 3"—1 min 15.0 sec for the bubble to ascend.
"Z — 4"—1 min. 35.0 sec for the bubble to ascend.
"Z — 5"—2 min. 35.0 sec for the bubble to ascend.

These heavy bodied liquids move in pipe lines according to streamline flow, also known as viscous or laminar flow. It consists of movement in which each particle of fluid pursues a smooth path parallel to the walls of the pipe. The path of one particle does not at any point cross the path of another. This type of flow takes place when thin liquids flow at low velocity or when viscous liquids flow in small diameter pipes.

There are two accepted methods of allowing for the effect of joints, fittings and incidental losses generally found in a pipe line. Either adds a certain number of diameters for each fitting to the length of the line, or increases the pressure drop by a certain number of velocity heads. The additional length method is perhaps the easier to use.

In short pipe lines with a large number of fittings, it is not uncommon for shock losses in fittings to be greater than friction losses in straight pipe.

Another factor affecting motor capacity is the specific gravity of the liquids pumped. The heavier the liquid, the greater the force required to move it. Specific gravity is the ratio between the weight of a volume of the liquid, and the weight of an equal volume of water.

The following formula [from the book Pumps, by Kristal and Annett] can be used to find the brake horsepower:

$$Hp = \frac{\text{gpm} \times H \times S}{3{,}960 \times E}$$

where Hp = brake horsepower; gpm = gal per minute; H = dynamic head, ft; S = specific gravity of the liquid; E = efficiency of pump, expressed as a decimal.

Put Pump Near Its "Supply"

An experience at Tousey well illustrated one of the rules of good piping procedure. Their north pump house was in operation first, and they were trying to pump viscous liquids from tank cars at the south end of the yard. Even though the contents of the tank cars were heated to 135 F, the liquid cooled so much in transit that it stopped flowing in the suction hose. They even tried steam-jacketed hoses, but these weren't satisfactory.

When the south pump house was built, it was closer to tank cars at the south end of the yard, and viscous liquids didn't cool off so much in the shorter suction hose. This emphasizes the rule that the pump should be as near its "source of supply" as installation conditions permit.

Good engineering warrants a careful study of conditions to as-

sure economical size and arrangement of piping. To say that a pump is no better than its piping system is about right, for if the piping head losses are excessive the pump must operate at reduced capacity and efficiency.

This results in high power consumption. These objectionable and costly conditions can be avoided by simple methods of analysis which include combining pump and pipe line friction-head characteristics.

Dougherty Bros. feel that undue emphasis has often been placed on pump and prime mover efficiencies without due regard to the importance of the piping and other installation factors that affect overall efficiency of the system.

Frequently, a pumping installation may be incorrectly made without directly affecting the pump efficiency. Yet it will increase power consumption due to high pipe friction, velocity head and other losses. Other unwanted effects may be a decrease in pump efficiency due to hydraulic losses, eddies and whirls in the suction inlet; air in the suction; or excessive pump thrust that may cause troubles.

Dougherty Bros. make it a practice never to use pipe smaller than the pump nozzles, and preferably larger—especially on the suction side. By using eccentric reducers from the larger suction pipe to the pump nozzle, formation of air pockets in the pipe is prevented. Tapered reducers on the suction and increasers on the discharge help to assure efficient flow and conserve power.

Instead of sudden or abrupt changes in pipe sizes, they use tapered increasers or reducers. Depending on the job, they select pipe and fittings that keep friction losses to a low value. Also, they run all piping as directly as possible with a minimum of elbows and fittings.

A pipe line elbow in a horizontal plane at the pump suction nozzle tends to cause unequal thrust and hydraulic losses because the liquid tends to fill only one side of the suction chamber in some types of pumps. To give the flow a chance to straighten out before entering the pump, a straight pipe four to six diameters long between the elbow and suction nozzle is used.

Whenever possible, the suction reducer and discharge increaser are installed directly on the pump nozzles. This produces better conversion of flow velocity and reduces hydraulic losses that might be caused by valves or elbows directly on the pump.

On the Tousey installation, as others, Dougherty Bros. supported the piping so its weight would not be on the pump. Before tightening the pump suction and discharge flange bolts, they made sure everything lined up. Otherwise there would be a strain on the pump, possibly causing misalignment.

To keep the pumps primed, Dougherty Bros. ran the piping upward from the pumps so liquid would always remain in the pumps. On the long runs of piping, provision was made for expansion and contraction of the pipe.

Explosionproof motors were installed in the pump houses. In addition to the motors being explosionproof, the lights and light switches in the pump houses are also explosionproof.

There was an interesting development as this article was going to press. The safety inspector from the insurance company visited the Tousey Varnish Co. and showed them statistics proving that eliminating the use of drums of raw materials by means of the new piping and pumping system had substantially reduced the rate of employee accidents.

[An article in the August HPAC described this piping system and its production advantages over handling materials in drums.]

ELECTRIC UNITS PREHEAT HEAVY FUEL OIL

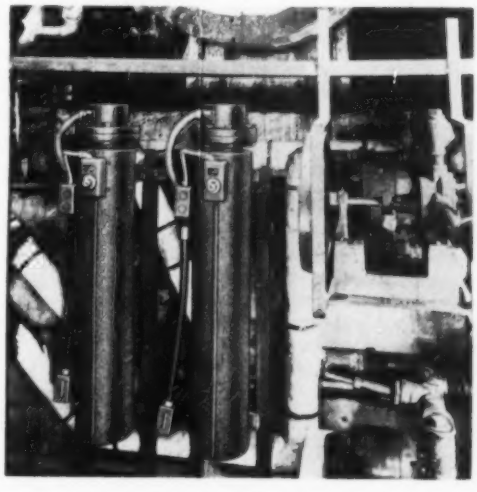
WHEN LIGHT fuel oils which can be readily pumped at ordinary temperatures are replaced by heavier, lower cost grades, preheating for easy pumping and efficient combustion is generally required. One method is to use electric circulation heaters either at the storage tank or the point of use.

A typical installation is the heating of bunker C fuel oil at the Polk Sanitary Milk Co., Indianapolis. Here, oil is electrically preheated for easy flow to the burners where it is again heated by low wattage cartridge heaters in the burner reservoirs.

One of two 10 kw circulation heaters operates 24 hr a day, seven days a week, at the oil storage tank which feeds two 225 hp boilers. Two burners on each boiler require 55 gph of oil. Normally, only one circulation heater is used to facilitate pumping and proper combustion at the burners, but when the second is needed it cuts in automatically. Pumping rate and outside temperature are factors that determine whether either or both heaters operate; built-in thermostatic control prevents under- or over-heating the oil.

The oil burning equipment and fuel oil system at this plant were engineered and installed by the mechanical division of the Muessing-Merrick Coal and Oil Co.

Two 10 kw circulation heaters for preheating bunker C oil at the Polk Sanitary Milk Co. (courtesy Edwin L. Wiegand Co.)



Four Oil Fired Units Heat Large Warehouse

Deliveries and shipments are made by trucks, so that the large dock doors are frequently open. This places an extra burden on the heating equipment

GEORGE T. COSTELLO, of the National Heater Co., describes an installation of four 1,000,000 Btu direct fired space heaters in the 161 by 650 ft warehouse of the Char-Gale Mfg. Co., where the heating problem is complicated by frequent opening of the large doors. One of the units serves the warehouse space around it, as well as the enclosed office area (through ducts)

WAREHOUSE No. 2 of the Char-Gale Mfg. Co., Minneapolis—a building 161 ft wide and 650 ft long, with an area of 104,650 sq ft—is heated by four direct fired heaters. Experience through two winters has shown that the building is heated evenly and efficiently, despite the comparatively severe weather conditions and the small number of units.

There are no ceiling-high partitions in the entire warehouse area, except those that separate the offices in one corner of the building. The ceiling is 16 ft high and flat; it is supported by steel beams and fabricated steel girders. The floor is concrete. Walls are face brick backed by 8 in. concrete building blocks. Windows are of glass blocks. There are no skylights.

The material stored consists of sheet aluminum, pipe, elbows, shapes, registers and ducts used in warm air heating installations. Partitions between storage sections rise to within 4 to 6 ft of the ceiling. At each end of the building, north and south, are four dock doors, electrically operated—each sufficiently large to accommodate semi-trailers 34 ft long. Midway in the east wall are two dock doors of the same size as those on the ends, which are for direct loading and unloading of railroad freight cars.

Deliveries and shipments are made by a fleet of trucks. During each working day, these large doors are opened on the average of one or more every 15 min. This frequent exposure to outside temperatures places an extra burden upon the heating equipment.

One Heater Also Serves Offices

The heaters are placed against the east-west outside walls, directly in line with one another, and are approximately 100 ft in from the north and south loading docks. Three of them serve entirely as

space heaters, distribution being provided by high velocity air discharge through the large adjustable grilles. The heater in one corner handles the area around it as well as the adjacent office space through a system of supply and return ducts.

Each of the four heaters has an output capacity of 1,000,000 Btu and 12,500 cfm and is powered by a 5 hp, three phase motor. The comparatively small overall measurements of the heater, (80 in. long by 48 in. wide) conserve valuable floor space and by employing separate induced draft blowers, a positive year-round draft of a fixed intensity is insured without the use of individual masonry chimneys. Stainless steel firebox construction contributes to the efficiency and speed with which these heaters arrive at a normal operating temperature.

The oil burners are fully automatic and are of the rotary type suitable for burning commercial No. 5 and heavier oil, with preheating accomplished through electric resistance coils.

If at any time this building is subdivided, the present installation could be used for heating each section, without changes or alterations in the system.

Fuel Oil Consumption

The owner reports complete satisfaction with the economy and performance of this system and comments favorably on the ability to maintain a consistent, even temperature over the entire floor area in spite of the fact that very little duct work is employed and the flow of air is partially obstructed by numerous 12 ft high bins.

According to the owner's records, fuel oil consumption for heating the warehouse was slightly under 41,000 gal for the 1948-49 heating season of 7633 degree-days. For the 1949-50 heating season, with 8322 degree-days, the oil consumption was something less than 45,000 gal. The average temperature carried throughout the warehouse during the heating seasons was slightly above 65 deg.

The heaters are rated at 1,000,000 Btu and 12,500 cfm each, have fully automatic rotary type burners for burning No. 5 and heavier preheated oil

The fuel consumption and degree-day figures probably do not present a completely accurate picture of the heating cost of such a large building with an unusually high exposure factor, on the one hand, and because the degree-days for nights, Saturdays, Sundays and holidays, when the heating system is completely shut down, have not been subtracted, on the other hand.

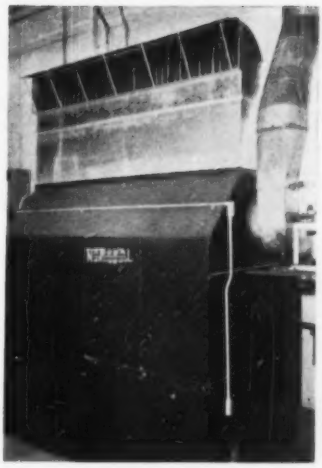
REFRIGERANT'S PROPERTIES AFFECT SYSTEM COST

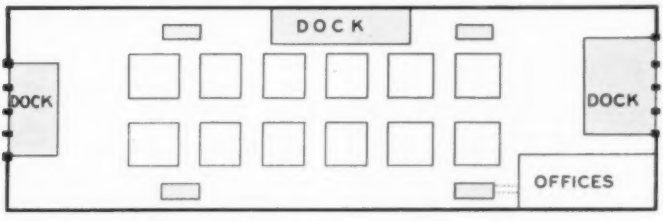
THOSE WHO install refrigeration and air conditioning equipment, like other human beings, tend to take commonplace things for granted. Among such things are the large size pipes required with "Freon 12" refrigerant and its rather poor (comparatively) heat transfer characteristics.

The new refrigerant "Carrene-7", described by C. M. Ashley at the recent national meeting in Kansas City of the American Society of Refrigerating Engineers, was designed to develop greater capacity than "Freon 12" in the same compressor. It is very important, however, to note that its physical properties are such that it should have better heat transfer characteristics than "Freon 12" and also should require smaller size pipes. By improving the efficiency of heat transfer equipment such as coils and condensers and by reducing the size of piping, the cost of the refrigeration system could be decreased.

Those who have worked with ammonia as a refrigerant, especially in the design of heat transfer equipment, are familiar with the pronounced improvement in heat transfer of ammonia as compared to "Freon 12" and also the very great difference in size of piping required. If ammonia could be used in air conditioning systems, the cost of coils, condensers and piping would therefore be greatly reduced. Obviously ammonia cannot be used in air conditioning systems or for that matter in many applications of refrigeration but it does indicate the possibility of going even further in the improvement of thermodynamic properties than was done with "Carrene-7."

"Freon 12" is an excellent refrigerant for small and medium size refrigeration systems and has properties that are well suited for large centrifugal compressor systems. There is considerable room for the development of an improved refrigerant for air conditioning systems of the larger sizes using reciprocating compressors, a refrigerant with improved heat transfer and fluid flow characteristics. In the words of one observer at the Kansas City meeting, spoken off the record, "What we need is an azeotropic mixture of attar of roses and ammonia".—D. D. WILE, chief engineer, Refrigeration Engineering, Inc.





Four direct fired heaters are spaced uniformly in the warehouse. The unit in the lower right corner also serves the offices through ducts

QUESTION of the Month

IN THIS REGULAR feature, specific questions on heating, piping and air conditioning which have been asked by HPAC's readers are answered both for the original "asker" and for others as well. The editors hope you'll find these practical comments of regular monthly interest, will contribute either questions or answers yourself when the occasion arises.

The replies this month are in answer to "R.A.," who asked for assistance on a problem encountered in one of his air conditioned buildings, which is served by two air conditioning systems of 200 tons capacity each, and with each system comprising a flooded chiller, superheater, two 100 ton compressors arranged to give four steps of capacity, and two evaporative condensers. The systems were first put in service last summer, and ever since then he has been bothered by the compressors losing their oil pressure and shutting down. This is apparently caused, he thought, by the oil actually being carried out of the crankcase by the "Freon," or the oil being diluted by the "Freon." To add confusion, one compressor may shut down on low oil pressure while its mate on the same system will continue to run; then again, both of them will shut down.

OUTLINES CAUSES OF OIL PRESSURE LOSS

REGARDING "R.A."s question on page 109 of the July HPAC relating to loss of oil pressure on "Freon" compressors, it would appear that this is most likely due to liquid refrigerant flooding into the crankcase via the suction line due to improper functioning of the device used to control the flow of refrigerant into the evaporator. The result of liquid entering the crankcase would be foaming of oil to result in excess quantity passing the piston rings, and also loss of pump pressure due to boiling of the refrigerant in the oil pump to cause vapor lock.

If the trouble is due to refrigerant flooding into the suction line, I venture to predict that when only one compressor loses oil pressure, it is the one that has the most direct gravity flow path from the main suction line, such as the compressor nearest the evaporator being connected to the suction line via the side of a tee where the side connection points down or from the bottom of the suction line.

As to the other alternative of loss of oil from the crankcase to uncover the oil pump suction pipe, this lost oil could be trapped in the evaporator by a short refrigerant charge.

Apparently "R.A."s compressors are not equipped with any oil level observing means, for if they were it would not have been necessary to speculate on low oil level affecting pump output pressure.

No statement is made that oil pump pressure has been restored by adding oil to the crankcase. If any quantity of oil has been added exceeding crankcase capacity, it must be either trapped in the evaporator or in the receiver on top of the refrigerant.

If oil is reaching the evaporator in quantity, it must be passing through the oil separator. Oil separators are less effective if located close to the compressor discharge, where oil globules are still atomized. It is assumed that the oil separator is correctly installed in the discharge line (we once found one installed in a liquid line) and that the oil return line to the crankcase is not clogged. Besides, if the system design provides proper oil return from the evaporator, an oil separator would not be necessary.

Oil with liquid "Freon-12" floats on top of the refrigerant, as contrasted to ammonia with which the oil settles to the bottom. Therefore, the existing oil return from the chiller, if intended to be automatic, may not be effective. Pumping out and draining oil from the evaporator (chiller) would readily reveal the presence of oil.

The fact that oil floats on "Freon-12" means that a considerable quantity of oil can be accumulated on top of the liquid in the receiver.

Where two compressors operate on one system, both compressors should be mounted on the same level. One oil level equalizer line should be provided of not less than 1 in. size connecting to each crankcase at the minimum safe oil level, and one pressure equalizing line should be provided of not less than ½ in. size connecting to the upper part of each crankcase above the maximum oil level. This latter line can be omitted if the suction line service shutoff valves are always left open, and a check valve does not exist between the suction port and the crankcase to prevent the suction line serving as a pressure equalizing line.

Since "R.A."s trouble has been present since his systems were first started up, I strongly suspect that refrigerant is flooding back to the compressors. Presence of excessive noise at times due to pistons pounding liquid against valve plates would be a sympton. If temperature readings taken simultaneously at the evaporator suction connection and at the compressor suction are less than 10 F higher at the compressor, flooding is conclusive.

Probably the best approach would be to call in a field engineer of the manufacturer of the refrigerant control, be it high side float, low side float or expansion valve. Foreign matter in the control, preventing the valve element from closing, dirt, solder, or pieces of thread compound, should be looked for. That the control is not oversize should be verified.

If an expansion valve, determine if it is intended to have an external equalizer connection. Valves intended to have an external equalizer connection will not operate with this connection plugged off and omitted, even if the pressure drop through the evaporator is sufficiently small not to create need for an external equalizer.

If a float control, determine that the linkage is correctly adjusted to

close the valve element with the float ball in the proper position. Some float controls have more than one port, requiring that certain ports be plugged off depending on the specific application. This is a feature that has embarrassed some installers.—W.E.P.

USE DIRECT EXPANSION EVAPORATOR

IN ANSWER to the air conditioning problem from "R.A." on loss of oil pressure with his compressors, as given on page 109 of the July HPAC, my opinion for corrective steps is as follows:

The two statements made by "R.A." as to the apparent cause are correct, but I would suspect the oil return line from the chiller and the flooded type of evaporator.

Since "Freon" and the oils used for this type of refrigerant readily mix, the problem of keeping each in its original state is a difficult one. In addition, oil returned through the chiller return line is of low temperature and pressure with the possibility of the greater percentage returned being the refrigerant.

It would be my guess, if this line is insulated, that the covering should be removed and other provisions made to handle condensation formations.

Flooded chillers or evaporators of this design have been known to harbor oils and cause oil logged conditions. The boiling action created in this chiller by the load usually returns a refrigerant in a vapor state. Vapors under these conditions return very little oil. The oil remains in the evaporator because of temperature and can only be removed by a return line. If the oil return line is constantly in an open position, it can readily be seen that compressor efficiencies will be reduced.

To sum this all up, it is my contention that a direct expansion evaporator replace the flooded one and the oil return line be removed. —L.L.S.

WELDING MACHINES HANG FROM CEILING

HANGING a-c welding machines from the ceiling at the Springfield, Mass., plant of Harvey-Whipple, Inc. gives many advantages. In addition to important savings in floor space, the ceiling location provides better ventilation and keeps the machines from being bumped or jarred. Since long, across-the-floor runs of welding cable are not usually required, the cable is rarely subjected to abuse and lasts longer. And, hanging the welding cable directly on the welding machine, the operator has plenty of room to clean his work area of scrap and dirt.

Because of the inverted installation, covers can be removed to facilitate inspection and allow better circulation of the ventilating air. The welder is readily adaptable to this type of mounting because it is ventilated by natural air convection currents, and the current indicator dial is easily read and adjusted in this position. (Photo courtesy Westinghouse Electric Corp.

Suspending these a-c welding machines from the ceiling in a manufacturing plant has resulted in a number of advantages in addition to saving floor space

Neighbors Object to Odors Created by the Exhaust from Drying System

YOU ARE INVITED to answer the following question which has been asked by a reader of HPAC. Suitable comment on the matter will be welcomed and—space permitting—will be published. Sketches or photos are particularly desired. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"I would appreciate having information on the ventilation requirements in connection with the drying of cement used to fasten automobile brake linings to brake shoes. A phenolic resin varnish is employed, drying being accomplished by a number of electric bulbs which emit a large amount of radiant heat.

"There have been a number of complaints from neighbors who object to the odors which are carried out of the building by the present exhaust system, and I have been asked for advice on correcting the situation."—G.C.

Sam Lewis' Page

Two Poorly Designed School Jobs Teach Heating Lessons

OCCASIONALLY one encounters a heating plant in a public building that, through ineptitude in design, may form the basis of a tale.

Heating engineers frequently are compelled to unsheath their swords in defense against pressure by owners or architects for reducing investment. Some ultramodern school buildings are planned without basements and without attics, so that the heating plant designer often needs his sword to gain some space that will be acceptable to the architect for ducts and pipes without aborting efficiency or discounting comfort.

One such single story, large elementary school originally was designed for hot water radiant underfloor heating, and with air ducts above a central corridor. The architect decided on secondary overhead solar lighting by high-up windows on the sides of each room opposite the outside window-wall. He lowered the roof over the corridor in order to gain these high-up windows, and abolished the originally acceptable duct spaces. Then, to reduce investment still further, all ventilation—except by windows—was deleted. Further to reduce investment, the underfloor radiant heating was omitted and hot water radiators along the outside walls were substituted.

No exposed pipe mains in the classrooms to serve the radiators could be countenanced by the architect, and he suggested pipe trenches all around the outside walls. I declined to participate in such trenches unless they were to be deep enough and wide enough in cross section so that the flow and return mains could be inspected, and serviced if necessary, during the many future years. The cost of lowering the footings and building such trenches appalled the architect, so that this scheme was killed.

Mains Threaded Through Rafters

The building ultimately was built with the flow and return mains overhead threaded through the steel skeleton rafters above the sloping ceiling, serving radiation at floor level, a system only possible with hot water. The warm mains were insulated as well as is possible, an irritating task with the small clearances between the pipes and the truss-like members of the rafters. The thin roof above the piping was well insulated below the watertight composition surface. Then the plaster was to be applied below the mains and branches, which thus would be thoroughly hidden and well arranged to prevent inspection or maintenance.

After much "sword work," however, I succeeded in obtaining a continuous screwed-on removable panel of fireproof composition under the mains, to blend with the adjacent plaster. If an accident, such as might result from freezing, should occur, the leak can thus be located and probably can be repaired.

There is another case of a two story, 10 classroom and gymnasium, semifireproof school, built in 1928. There is no basement, except at one end for two large warm air furnaces, a supply fan and a coal room. The fan was intended to force about 20,000 cfm of cold air around the furnaces and then, due to encroachment by a stairway, the heated air must flow downward into a distributing chamber. There was a horizontal deck across this chamber, 30 in. above the furnace room floor level. A separate air supply duct extended from the chamber to each principal room in the building, 15 such ducts being provided. Each duct had two interconnected center-pivoted dampers, one to take air from the upper warm air chamber, and one to take air from the chamber below the deck. The dampers in each duct connected to a thermostat in the respective room.

The principle of operation is old,

INFORMAL comment on heating, piping and air conditioning matters is given in this regular feature by Samuel R. Lewis, well-known consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors. He devotes his "Page" this month to a discussion of a couple of school heating jobs where difficulties were encountered, and explains how the problems were solved

and such a plant will work, provided that there is an ample supply of warm air capable of reaching all of the damper openings in the upper chamber, and provided that when any room becomes sufficiently warm, there is a copius supply of air at a few degrees cooler than the usual 70 deg desired in the rooms. As one damper closes, the other damper opens, so that a continuous volume of air is delivered, at a temperature varied as required for the room. This temperature of course must be warm enough to balance heat loss through walls and glass, and must be cool enough to balance heat gain from sunlight and people.

"This Very Sick Job"

In this very sick job, however, no provision was made for any supply of air to the chamber below the deck. The sheet metal ducts for air delivery to the first story rooms were concealed above the suspended plaster ceiling of the corridor. All of them came from one end of the building, thus resulting in a much greater resistance to air flow for remote rooms than for those rooms nearby. The supply ducts for the second story rooms, however, were extended as a group, clear into the attic, through a very large vertical shaft that was open to the attic.

In the shallow attic, the 10 separate air supply ducts were extended until each reached the neighborhood of its particular room, then turned down along the inner wall of the room (a drop of about 5 ft) to an elbow facing through a grille into the classroom. The attic and the vertical shaft were in open communication.

The roof was of thin concrete, without insulation, below a tar and gravel waterproof top. The attic was open to the outside air through two large round metal ventilators. The air supply for the plant was taken from above the roof through dampers that were far from airtight, and provision was made for alternative recirculation of air from the attic through other dampers that were glorified sieves. The scheme here was to open the outside air intake, open the ventilators and to close the recirculating dampers during school sessions. When heating prior to occupancy, the outside intakes and ventilator dampers were to be closed and the recirculating dampers were to be open.

I found the following:

The plant never had heated the building acceptably in weather colder than about 40 deg.

Heating of the second story rooms, having long ducts in the cold attic and handicapped by the necessity of forcing warm air downward, always was far behind the heating of the more favorably served first story rooms.

After any room became warm, the thermostat in that room asked for a continuous supply of air a little cooler than 70 deg, but no such air was forthcoming since no air could enter the air supply chamber below the deck. In an attempt to remedy this, some genius—in days long past—installed a fixed metal prop in each of the mixing dampers which prevented any damper from closing more than about 75 percent. He thought that if a room became too warm he would alleviate the situation by preventing the thermostatic mechanism from shutting off all of the warm air.

"At Serious Damage To My Clothing"

I crawled (at serious damage to my clothing) through the only means available for access to the supply fan inlet. This involved 15 ft of an exceedingly dusty space below the deck, and passage through an 18 in. high door. The fan bearings had been kept well oiled through a copper tube leading out to civilization, and the viscous oil, spilling over, had accepted dust and pigeon feathers and the like ever since 1928 when the fan was installed. There was practically no clearance for air to blow between the 64 blades of this 48 in. diameter wheel. The janitor had not visited this decidedly inaccessible spot for some eight years.

The janitor has been replaced. The attic ducts have also been replaced, with new ones at second story ceiling level. The fan has been moved out into an accessible walk-in room, with a new independent outside air intake, and with a new, tight, alternative recirculating duct and dampers. Provision has been made for plenty of air in both chambers, at 135 deg above the deck and at 65 deg below it, so that as any room gets too warm, it will gradually be cooled by a gently modulated air stream. The architect who permitted the installation of this unpedigreed heating plant will not be re-engaged. The community must pay for what practically is a second heating system for the building.

FLOOR HEATING FOR CLASSROOMS

THIS IS IN answer to the inquiry from "W. H." in the June issue as to whether radiant heating in the floors of school classrooms is good or bad as far as the health, erudition and comfort of the pupils is concerned.

There are not very many radiant-floor-heated public school classrooms as the construction of such heating systems in this country is relatively new.

About 1910, I employed radiant heating in the floor of a very large gymnasium. The plant was economical and satisfactory and won many compliments. The graduates of that school are as long-lived as those from any other school and the old gymnasium still is in service. The design was to warm the floor only to 60 deg.

In 1913, I designed radiant underfloor heating in a so-called open air school. The floor temperature was controlled at about 80 deg regardless of the air temperature. This large public school was always popular and the fuel cost especially was low. After about 20 years of operation, the open air fad became outworn and the occupancy was changed to normal grade pupils. To this day, this particular building is one of the most satisfactory and economical and popular among some 60 other grade schools in that city.—S. R. L.

NATIONAL ACADEMY TO MEET AT G.E. LABORATORY

THE NATIONAL Academy of Sciences, whose membership includes many of the leaders in U. S. science, will hold its autumn meeting at the recently completed quarters of the General Electric research laboratory near Schenectady, N. Y. This will be the first time in its 88-year history that sessions have been held at an industrial laboratory.

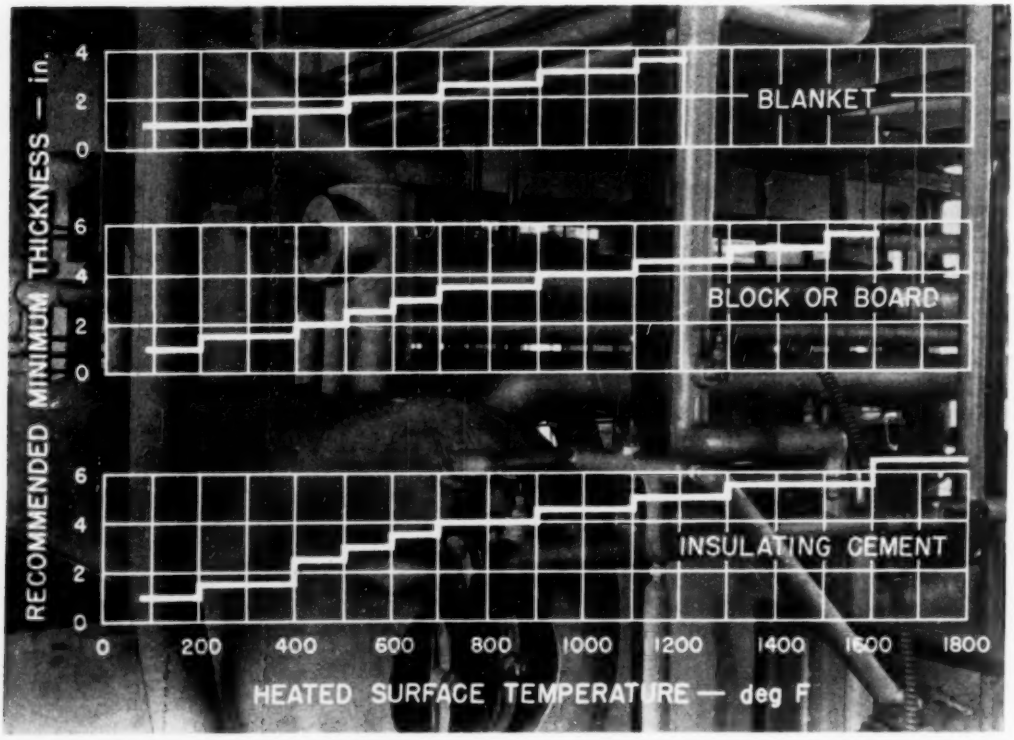
DATA *sheet*

HOW MUCH INSULATION?

INDUSTRIAL insulation pays for itself many times over in heat savings when applied to the proper thickness. Where it's too thin for the job, you don't get the results you are paying for. Where it's too thick, you are buying more labor and more insulation materials than you need.

The type of insulating material, as well as the heated surface temperature, determines the proper insulation thickness. At temperatures from 70 F to 1800 F the chart superimposed on the photo gives the minimum thicknesses of mineral wool in its blanket, block (or board) and insulating cement forms. It was prepared by the Industrial Mineral Wool Institute.

Commercial Standard CS117-49, Mineral Wool Insulation for Heated Industrial Equipment, recommends these thicknesses for indoor locations. Outdoors, add half an inch; for underground installation, subtract half an inch.



Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

Roof Spray for Reduction in Transmitted Solar Radiation

By G. E. Sutton,* Gainesville, Fla.

SUMMARY—The effectiveness of roof sprays as a means of limiting surface temperatures of roofs exposed to solar radiation is shown by results of experiments in which adjustable two-nozzle rotating type roof sprays were operated under control of a temperature bulb placed ⅝ in. below the roof surface.

Tests proved that the surface temperature of a roof which would reach 150 F under maximum solar intensity if unsprayed, could readily be maintained at 100 F when sprayed. By comparison, 2-in. and 6-in. pools of water on the roof would maintain surface temperatures of 108 F and 103 F, respectively.

An equation for instantaneous heat flow through roofs is developed. Advantages of the spray system are given.

THE UTILIZATION of solar energy[1] has been given much study at the University of Florida and other institutions. In Florida the solar radiation incident on a horizontal surface may be as much as 2300 Btu per (sq ft of surface) (day). This is nearly the heat equivalent of one horsepower-hour, or about two-thirds of the equivalent of one kilowatt-hour. If the heat received is visualized for an area of 1000 sq ft, the value of utilizing this energy is obvious.

There are cases, however, where this energy produces undesirable results. For instance, 320 Btu per sq ft per hr incident energy on an asphalt-slag roof will produce a surface temperature of about 150 F. It is obvious that, with an inside air temperature of 90 F or less, considerable heat transfer would take place, especially if the roof were of light construction.

This heat in conjunction with heat transfer through walls, windows, and other surfaces may serve to increase the temperature within the space to undesirably high values. In the case of warehouses, certain goods may deteriorate at such high temperatures. In air-conditioned buildings, this heat may form a substantial part of the cooling load.

Any means which reduces the surface temperature will reduce the transfer of heat into the space correspondingly. One of the means used has been the placing of permanent pools of water on the roof[2,3,4,5]. Date storage buildings in California have been built with direct expansion or cold water coils on the roof. In some cases, refrigeration coils have been placed just under the roof but in such installations the difference in temperature between the top and bottom of the roof created serious thermal stresses. While insulation serves to reduce the heat flow by increasing thermal resistance, rather than reducing the surface temperature, it causes high surface temperatures which have a deteriorating effect upon the durability of asphalt roofing, due to such effects as swelling, blistering, and vaporization of the volatile oils[4]. Upon the occurrence of thunderstorms, quite prevalent in Florida, the sudden cooling of the roof creates a serious thermal shock.

*Assistant in Research, Mechanical Engineering Department, Engineering and Industrial Experiment Station, University of Florida.

[1]Exponent numerals refer to References.

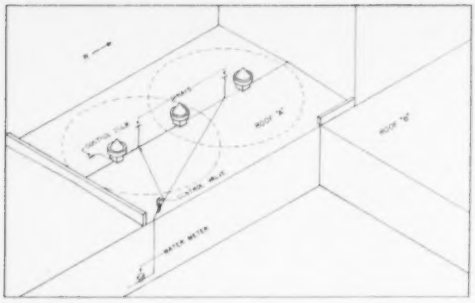
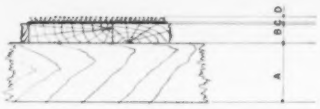


Fig. 1—Isometric view of roofs and roof spray installation



A-8"X10" WOOD FRAMING
B-2" WOOD SHEATHING (PINE)
C-2 PLY ASPHALT ROLL ROOFING
D-ASPHALT AND SLAG (ABT 1/2")

Fig. 2—Cross section of roofs used in test

Experimenters at the University of Texas[2] have found that pools of water two inches and six inches in depth would maintain a surface temperature of 108 F and 103 F respectively. One disadvantage of waterpools is the structural difficulties involved in supporting the water, especially on large, flat buildings. The large quantity of heat stored in the water is also a disadvantage since a considerable part of it is transferred into the building in the late evening. Stagnant pools of water also present ideal locations for mosquito breeding, and for growth of algae[3]. The simplicity of pool systems is also reduced by the need for changing the water at regular intervals or for chemical treatment of the water.

The object of the experiment covered by this report was to determine the feasibility of using a roof spray as an economical means of reducing transmitted solar energy, and to determine factors affecting the design of a roof spray system.

Apparatus

Fig. 1 is an isometric sketch of the building and the spray installation. The two roofs designated by A and B were of identical construction of the type shown in cross section in Fig. 2. The two sections of the building house two portions of a machine shop, and are connected by a doorway. The slopes of the roofs are about one-half inch per foot, so slight that the roofs may be considered flat without serious error. Fig. 3 is a photograph of the sprays in operation.

The sprays were originally of the four-nozzle rotating lawn type, having fixed nozzles of four different types for uniform coverage. These sprays were replaced with the adjustable two-nozzle rotating type which could be adjusted for throw and fineness of spray. The throw was set at about 18 ft with medium spray. The approximate coverage is shown by the dotted circles on Fig. 1.

Control of the system was based upon a sub-surface temperature. The control valve shown is an electric motorized type controlled by a temperature controller with the bulb placed as shown in Fig. 1. This bulb is buried under about $\frac{1}{8}$ in. of asphalt and approximately $\frac{1}{2}$ in. of slag. The bulb was placed thus in order to prevent frequent cycling of the system. If it were placed in view of the sun, it would dry much more rapidly than the roof, and would start the spray system before the roof had again reached the control temperature. This would result in considerable wastage of water, and very little added cooling. A slight time lag was expected due to the resistance to heat flow of the asphalt, but more positive control was expected.

The water meter was of the dial type, commonly used in city water systems. It was calibrated and found to be accurate within less than one percent at the flows required by the system.

A continuous record of incident solar energy was made possible by use of a single point (curve drawing) recorder.

Ten temperatures were measured and recorded by a ten-point temperature recorder as follows: Outside air dry bulb, outside air wet bulb, spray water, sprayed roof surface, unsprayed roof surface, ambient at control bulb, ceiling surface under sprayed roof, air at 6 and 12 in. below the ceiling under the sprayed roof and at the breathing line (five feet from floor).

The rate of heat flow through the two roofs, and the surface temperatures of each ceiling, were measured by heat meters. The meters consisted of plastic plates containing an iron-constantan thermocouple and a multi-junction thermopile. They were used in conjunction with a portable potentiometer. A selector switch arrangement was made in order to facilitate readings, since copper leads were used with the thermopiles, and iron and constantan leads with a cold junction were required for the thermocouple.

A continuous record of spray operation was obtained from a rebuilt time-temperature recorder in which the recording pen was actuated by a solenoid, rather than a pressure-temperature element. A mercury switch installed on the actuating arm of the control valve operated the solenoid, recording the time when the sprays were turned on and off.

Procedure and Results

Control Temperature. Control of the system was based upon a subsurface temperature as previously stated. Data were collected at control settings of 95, 100 and 105 F. Results obtained at 95 F indicated that attempts to maintain any lower temperatures would be useless on clear days. Inclement

Table 1—Summary of Test Data from Figs. 4, 5 and 6

Figure No.	Temp. Control Setting F	Total Daily Incident Solar Radiation Btu/sq ft	Daily Inward Heat Flow Btu/sq ft		Water Used Gal/sq ft
			Sprayed Roof	Unsprayed Roof	
4	95	2162	31	139.2	0.919
5	100	2180	22	138.8	0.485
6	105	1842	30	119.4	0.141

weather was encountered before any temperatures higher than 105 F could be investigated.

As in most phases of engineering design, maximum conditions in this case should be considered. These would occur when there was no cloudiness, and on a day during the months of maximum solar radiation, June, July, August, and early September. The occurrence of an absolutely clear day during summer in Florida appears highly unlikely. However, the data collected on the days which approached nearest to this condition during each run were used in constructing Figs. 4, 5, and 6. August 8, 1949, was the nearest to an absolutely clear day encountered. For this reason heat flow and other data were obtained until the heat flow through the unsprayed roof returned to a value of zero.

Study of this heat transfer curve from a mathematical viewpoint shows the curve to resemble one wave of the sine curve (a plot of the equation $Y = k \sin X$). An empirical equation which very nearly fits the curve (disregarding the dip occurring at about 14:00[1]), is as follows:

$$q = 18.3 \sin\left[\frac{\pi}{12}(t - 9.5)\right] \quad \ldots\ldots(1)$$

where:

q = heat flow, Btu per (hour) (square foot).

t = time (24 hour system), hours.

Fig. 7 shows a comparison of the curve obtained by this equation and the curve plotted from test data. Further use of this equation (modified) is discussed in the Appendix.

The heat transfer curve will be symmetrical about a time axis at 15:30. Observation will show that the curves of heat transfer through both sprayed and dry roofs are approximately symmetrical at this same time. Analysis of the sine curve will show half the area to be on each side of this vertical line. Integration of the observed curves to a time of 15:30 and multiplication by 2 should give the total heat flow for a particular day.

By using these considerations, the various days may be compared. The summary of the data from Figs. 4, 5, and 6 is given in Table 1, the heat flow being derived in the manner outlined.

The ratio of heat flow through the *dry roof* to that through the *sprayed roof* for control temperatures of 95, 100 and 105 F was 4.09, 6.3 and 3.98, respectively. A comparison of these data show an apparently lower efficiency at the 95 F control temperature. This will be explained under the discussion of *Water Requirements*.

Effect of Buried Control Bulb. A time lag of about 20 to 30 min was observed due to the covering of the control bulb with materials resistant to heat flow. This was noticed only on the first operation of the day. (See Figs. 4, 5, and 6, observing the initial rise of the sprayed surface to a temperature higher than the control setting.) During the rest of the day a difference in temperature between the surface and that of the material adjacent to the control bulb of more than two degrees was seldom encountered.

Water Requirements. An attempt was made to evaluate the relation between total solar radiation incidence and the amount of water used. A plot of this relation gives a wide variation of values, the correct curve for which is difficult to determine and consequently any plot of this curve would prove unreliable.

It may be observed from Figs. 4, 5, and 6 that the value of incident solar energy required to produce the various control temperatures appear to be as follows: 95 F = 190 Btu per (hr) (sq ft); 100 F = 200 Btu per (hr) (sq ft); and 105 F = 210 Btu per (hr) (sq ft). Mathematical analysis will show, however, that when the air temperature is 93 F, only slightly over one Btu per (hr) (sq ft) is required to produce

Fig. 3—View of roof sprays in operation

[1] 24 hr time system. This system was used to great advantage and convenience by the armed forces during World War II, during which the author became quite familiar with it. It is deemed much more convenient, especially in mathematical relationships, than the 12-hr system. The time used was Eastern Standard Time. Sun time is approximately 34 min earlier than Eastern Standard during July. This varies from 44 to 12 min, the maximum occurring during February, and the minimum during October.

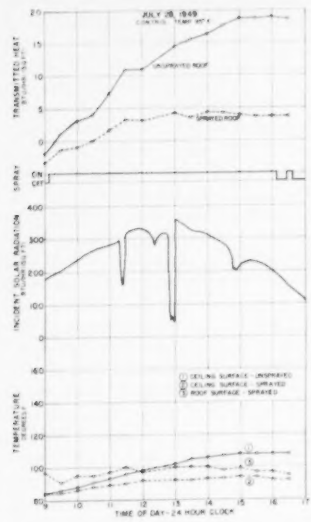


Fig. 4—Results for best day at 95 F control temperature

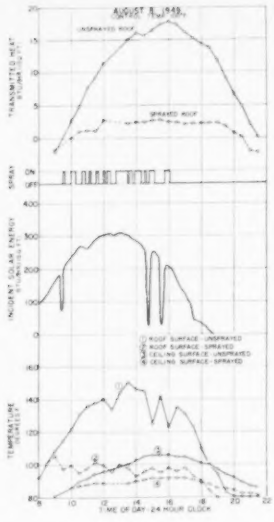


Fig. 5—Results for best day at 100 F control temperature

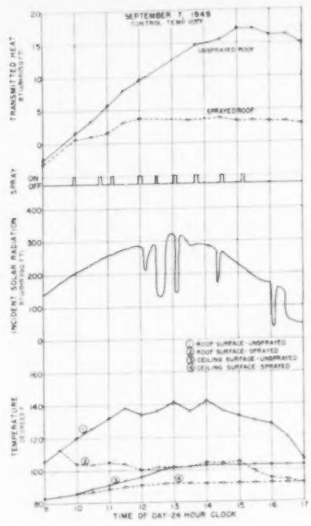


Fig. 6—Results for best day at 105 F control temperature

a surface temperature of 95 F; and only about three Btu per (hr) (sq ft) are required to produce a surface temperature of 100 F. The amount of solar radiation occurring during the morning will then affect the rapidity with which the roof reaches a given temperature and will directly affect the amount of water consumption. The amount of solar radiation during the rest of the day will govern the amount of heat to be dissipated. It may be concluded that, the nearer the solar radiation curve approaches the maximum curve, the more water will be required.

Insufficient data are available on solar radiation and cloudiness to determine whether or not the 1949 summer season was an average season. Therefore, no comparisons may be drawn for estimated water consumption on that basis. In this installation, the 2400 sq ft of roof required 85,767 gal of water between May 20, 1949, and September 30, 1949, or about 35.7 gal per sq ft.

Assuming that the evaporation of the water dissipated all the incident solar energy the efficiencies (the ratio of this solar energy to the energy required for evaporation of the water) of the three runs based on all the data are 25.5, 48.9 and nearly 100 percent at control temperatures of 95, 100 and 105 F respectively. During the operation at the various temperatures differing spray conditions were observed. During the 95 F run considerable water remained pooled on the roof, and considerable runoff was observed. This would appear to show that most of the reduction in heat was due to warming of the water, and not to evaporation. During the 100 F run a slight amount of water ran off, and the roof remained only quite damp. During the 105 F run, the roof remained fairly damp, and the runoff was extremely slight, just sufficient to show an abundance of water being supplied. These and other data, lead to the conclusion that the coverage of spray was too heavy.[4,5,6,7] A somewhat finer spray has been recommended, but should not be so fine as to be a mist. A mist would allow too much evaporation in the air prior to impinging on the roof. A high wind drift loss would occur thereby decreasing efficiency and creating a possible nuisance. Finer sprays would require less water for operation and greater efficiency should be expected.

If each of the 150 days between May 1 and September 28 were to be clear, with an average incident solar energy of 2200 Btu per (sq ft) (day), 40 gal of water evaporated at 100 percent efficiency would suffice to dissipate all of the solar energy for one square foot. Since the efficiency does not reach 100 percent, and since, conversely, each day is not clear, the conclusion is that the value of 40 gal per (sq ft) (season) is sufficiently high for a safe design figure.

Effect on Temperatures in the Space. The two roofs used for comparison were adjacent portions of a machine shop, connected by a doorway. Both spaces were well ventilated during working hours. The average air velocity adjacent to the ceiling was 100 fpm.

A decided cooling effect was noticed on the air above the roof, with some of this air spilling over the edges. During the time the sprays were in operation, and even with the roof wet, a decrease in air temperature of two to five degrees was

recorded by the dry bulb thermometer in the psychrometer placed on the west wall of the sprayed building. This cooled air was utilized to some extent by the ventilation of the spaces.

No difference was noticeable at any time in the wet bulb temperatures in the two spaces. During the time when the spaces were well ventilated, no difference was noticeable in the dry bulb temperature. Observations on a day when the space was closed showed a temperature difference of slightly more than one degree Fahrenheit in the dry bulb temperature. Despite the low temperature differential between the two spaces a considerable difference in comfort existed. On a day when the air temperature was 93 F dry bulb and 78 F wet bulb, and the space ventilated, the space under the sprayed roof was reasonably comfortable. In the other space, exposed parts of the body such as face and arms felt decidedly hot and uncomfortable in spite of the air movement. The effective temperature (ET) for a dry bulb temperature of 93 F and a wet bulb of 78 F with an air movement of 100 fpm is 83 ET.[5] The elevation of effective temperature for an increase in mean radiant temperature is approximately in the ratio of one to three.[5] With a ceiling surface of 108 F, the elevation in effective temperature would approach five degrees. An effective temperature of 88 ET with 100 fpm air velocity and 78 F wet bulb would be equivalent to a dry bulb temperature of about 112 F. Since the walls are at a lower temperature than the ceiling, the mean radiant temperature is actually somewhat lower than 108 F, but the parts of the body which can be *seen* by the ceiling will be subject to the radiant effect. In a closed space, the effective temperature is slightly higher due to the lesser air movement.

Fig. 8 shows the heat transfer from a painted surface (emissivity of 0.90) at various temperatures to air at 85 and 90 F. for air movements of 100 fpm and for natural convection. This is combined radiation and convection. The amount of heat transferred by radiation is dependent only upon the temperature differential between the surface and the air. The convected heat depends upon both the temperature differential and upon the velocity of the air. Therefore, the heat transferred with the 100 fpm movement is considerably higher than with only natural convection.

Design of Spray Installations

The most important features of the spray installation are the sprays and the spray control. A wide variety of spray heads is available. Fixed sprays, with heads giving full-, three-quarter-, half- and quarter-circle coverage with from 7 to 18 ft radius, having a great variety of elevation and fineness, are available. These should require less maintenance than rotating type sprays, provided the system is safeguarded against fouling by the use of strainers. Fig. 9 shows a typical layout of a spray system for a flat roof, using full- and half-circle sprays.

Sloping or gabled roofs may, in some cases, be more easily sprayed by perforated pipes. Fig. 10 shows an installation utilizing this form of spray. In large installations of this type, especially where the orientation of the building is such that the gable runs north and south, control of each slope separately and

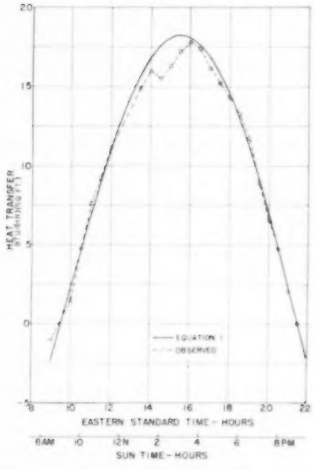


Fig. 7—Comparison of observed values of heat transfer with values calculated from Equation 1

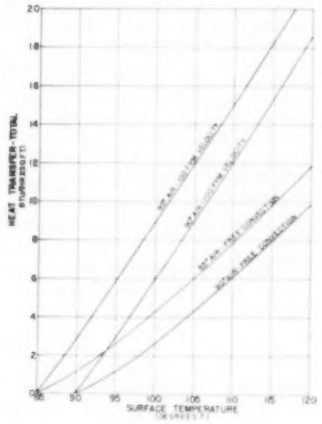


Fig. 8—Combined heat transfer by convection and radiation from painted surfaces to air

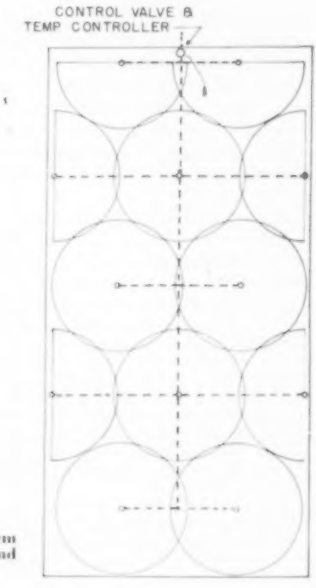


Fig. 9 *(right)*—Layout of spray system for medium-sized roof using half-and full-circle sprays

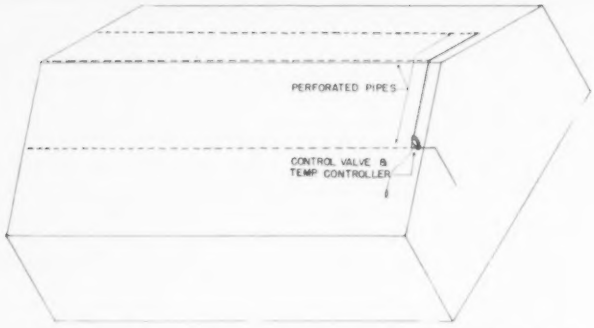


Fig. 10—Layout of spray system for pitched roof using perforated pipes

the use of two pipes at the crest may prove more economical.

For small installations (one or two sprays), the ordinary lawn spray of the rotating type will be easier and more economical to install. These, too, are available in a wide variety.

In any type of installation, the system can only operate economically if it is thermostatically controlled. Many varieties of required devices such as motorized valves, solenoid valves, and temperature controllers are available and can be arranged to best suit the individual installation. In most cases, electrical controls can be conveniently used or, where electricity is undesirable or unavailable, pneumatic controls may be used. For very large roofs zone control should be used. It is recommended that the piping be of brass or copper to prevent corrosion. This is especially important if any other than city water is to be used.

Conclusions

The following conclusions may be drawn from this investigation:

1. A roof spray of the rotating type can be made to maintain a surface temperature of about 100 F on a roof which would normally have a surface temperature of 150 F during the conditions of maximum incident solar energy.

2. The higher the surface temperature that may be tolerated, the more efficiently will the spray system operate, since more of the evaporative effect may be utilized.

3. Sprays are more effective than pooled water for cooling roofs.

4. Temperatures and comfort conditions within a space below a sprayed roof are desirably affected by spraying.

5. Some reduction in surface temperature of the walls of the building is produced by the spillage of cooled air from the roof.

6. Spray water has a preservative effect on asphalt types of roofing by reducing temperature change and lowering surface temperatures. There is, consequently, less thermal stress, less vaporization of volatile oils than for unsprayed roofs and there is no thermal shock from sudden thunderstorms.

7. Addition of insulation will decrease heat transmission, but will cause an increase in surface temperature, thus adding a deteriorating effect to some types of roofing.

8. Installation of sprays on conditioned buildings may serve to reduce the required refrigeration capacity, and thus present a saving in the cost of materials and installation.

9. The spray system, though simple in design, presents an efficient and economical means of reducing the effects of incident solar energy on roofs.

Acknowledgments

The author wishes to acknowledge the valuable aid of many members of the staff of the Florida Engineering and Industrial Experiment Station, University of Florida, both in carrying out the experiment and in preparing the report.

Special aid was rendered by L. H. Holder, April Showers Co., Washington, D. C., in making available reprints of considerable reference material.

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APPENDIX

Use of an Empirical Equation to Predict Heat Flow Through Various Types of Roofs

Two characteristics of materials affect the transfer of heat through different materials subjected to the same temperature differential. These are thermal conductivity, or ability to conduct heat; and thermal diffusivity, or the ability to diffuse heat within the material itself. Both affect the amount of heat transferred and the time lag between the time the temperature differential is applied and the time when heat actually begins to flow out of the material on the cooler side. In the case of periodic heat flow, that is, heat flow for condi-

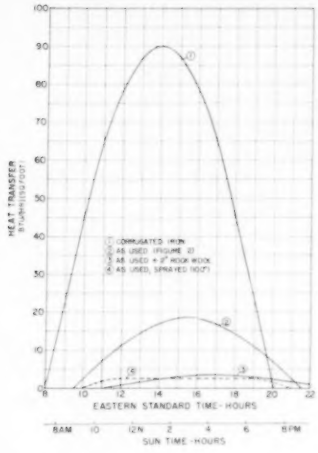


Fig. A-1—Heat transfer through three typical roofs as calculated from Equation A-4 and through test roof controlled at 100 F

tions where the variations in temperature follow identical cycles the period of the cycle affects the amount of heat transferred. Three factors affect the heat transfer: (1) U, the overall coefficient of heat transfer, Btu per (hour) (square foot) (Farenheit degree); (2) λ, a dimensionless reduction factor which is the ratio of the actual heat flow to that which would occur under steady state conditions; and (3) dt or time lag, hours.

The reduction factor λ is calculated from the equation[1]:

$$\lambda = e^{-x\sqrt{\frac{\pi n}{\alpha}}} \quad \text{(A-1)}$$

where

λ = reduction factor.

e = base of Naperian logarithms, 2.7128 . . .

α = thermal diffusivity, square foot per hour.

n = number of periods per hour.

x = thickness of material, feet.

The thermal diffusivity, a, may be calculated from the equation[1]:

$$a = \frac{k}{c_p \rho} \quad \text{(A-2)}$$

where

k = thermal conductivity, Btu per (hour) (square foot) (Fahrenheit degree per foot).

c_p = specific heat, Btu per (pound) (Fahrenheit degree).

ρ = density, pounds per cubic foot.

The time lag, dt, may be calculated from[1]:

$$dt = \frac{x}{2}\sqrt{\frac{1}{\alpha\, \pi\, n}} \quad \text{(A-3)}$$

where

dt = time lag in hours.

x = thickness of material, feet.

Using a weighted average of these values for the specific roof under consideration, Equation 1 of the paper may be revised to give the equation:

$$q = 64.3\, \lambda U \sin\left[(t\text{-}8\text{-}dt)\right] \quad \text{(A-4)}$$

where

q = instantaneous value of heat flow, Btu per (hour) (square foot).

λ = reduction factor.

dt = time lag, hours.

This equation is limited to the hours between 8:00 and 22:00, since the temperature variation curve is of the sine form only during the hours of incident solar energy and a few hours thereafter.

Using Equation A-4 as a basis for calculations, Fig. A-1 shows the probable heat flow through three roofs: curve 1 is for a corrugated galvanized iron roof; curve 2 is for the roof used in this experiment, (see Fig. 2); curve 3 is for the roof as used in this experiment plus 2 in. of rock wool insulation.

Table A-1—Conductivity, Reduction Factor and Time Lag for Three Roofs

Roof Type	U Btu (hr) (sq ft) (F deg)	λ	dt hours
Corrugated iron	1.40	1.00	0.00
As used in test	0.39	0.73	1.30
As used in test plus 2-in. rock-wool insulation	0.11	0.47	3.00

Curve 4 was added for comparison, and is the transfer through the test roof used, when it was sprayed to obtain 100 F surface temperature. Table A-1 shows three characteristics of the roofs.

These three types of roofs typify light, medium and heavy constructions. Equation A-4 is approximate, but indicates the effect of increased resistance to heat flow, and increased time lag. Integration of the three curves of Fig. 9 shows a total heat flow of 22 Btu per (sq ft) (day) through the sprayed roof at a control temperature of 100 F.

Though the insulated roof shows a heat flow of only slightly more than the sprayed roof, note that the heat flow continues far into the night; also the theoretical maximum surface temperature would be 175 F, or 25 deg higher than the dry roof without the insulation.

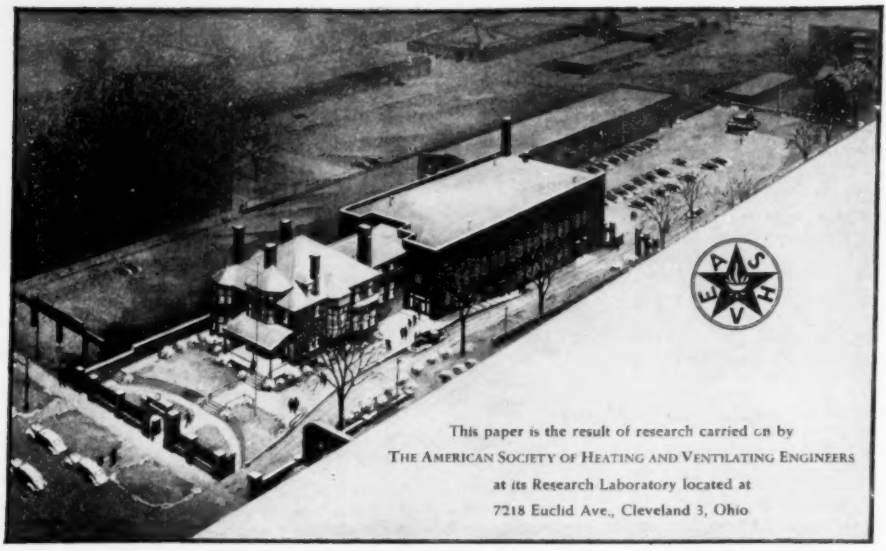
BASEBOARD RADIATION CODE

The I B R Testing and Rating Code for Baseboard Type of Radiation was adopted on May 24, 1950 by *The Institute of Boiler and Radiator Manufacturers* for the purpose of providing a reliable and uniform procedure for measuring the output of all types of baseboard heating units, including cast iron, copper, steel and aluminum, or combinations thereof.

The test procedure outlined in Part Two of this Code is based on experience obtained in several laboratories and provides, in the judgment of experienced engineers in the industry, a scientific and accurate method for determining capacities of baseboard types of radiation. A manufacturer may have tests conducted in a laboratory of his own selection. However, all of the observations taken and the results obtained during the test period are submitted to the Institute on forms provided for that purpose. The Baseboard Rating Committee, appointed by the Institute, reviews the data for the purpose of determining whether the tests have been conducted in accordance with the provisions of the Code and whether approval of the requested I B R Ratings is warranted.

The I B R Steam Rating is the condensation capacity of the baseboard under standard test conditions, plus a maximum of 15 percent. It is expressed in Btu per hour per linear foot, and also may be expressed in square feet of steam per linear foot. I B R Water Ratings are obtained from tests with steam by applying factors depending upon the average radiator temperature.

Inquiries regarding this Code should be addressed to *The Institute of Boiler and Radiator Manufacturers*, 60 East 42nd Street, New York 17, N. Y.


This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at
7218 Euclid Ave., Cleveland 3, Ohio

Energy Losses in 90-Degree Duct Elbows[†]

A Survey and Analysis of Available Information

By David W. Locklin*, Cleveland, Ohio

This paper is the result of research carried on by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS at its Research Laboratory located at 7218 Euclid Avenue, Cleveland 3, Ohio

SUMMARY—This paper presents an empirical correlation of experimental data for energy losses in 90-deg duct elbows. The correlation was developed from a critical survey and analysis of a large number of papers published in American and foreign technical literature. The equivalent length concept, as presented, appears sufficiently well founded to be suggested for use until such time as more comprehensive data become available.

As PART of the program of the Technical Advisory Committee on Air distribution[††], and the Subcomittee on Air Duct Friction, a survey is being made of available information on energy losses in duct fittings. The scope of the survey is confined to losses in through-flow duct fittings which provide for change in direction of the air stream; included are losses in vaned elbows, compound elbows, and certain special elbows. It is the purpose of this survey to assemble the available data, estimate the reliability and application of these data, suggest data which may be acceptable for use in design, and determine areas in which additional investigation seems desirable.

This paper covers flow energy losses in single duct elbows of 90 deg, assembled in duct systems and having substantially uniform cross-section throughout the bend. Attention has been given to the presentation of results in a manner which will facilitate their use in practical engineering calculations, with particular application to air duct design.

Nature of Flow in Duct Elbows

Flow Phenomena

The geometry of an elbow plays an important part in determining the nature of flow in it; however, certain characteristics of flow common to all elbows may be generalized.

As a result of his experimental investigation[1, 2] of velocity distributions in duct elbows, Weske describes three distinct regions of flow: (1) the core, (2) the shedding layer, and (3) the region of eddy-

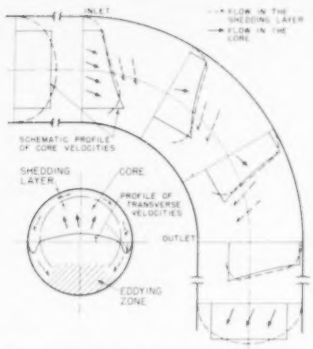
[†]Portions of this paper form part of a thesis submitted by the author to Case Institute of Technology in fulfillment of the requirements for the degree of Master of Science in Mechanical Engineering.

*Research Engineer, ASHVE Research Laboratory. Junior Member of ASHVE.

[††]Personnel: Ernest Szekely, *chairman*; N. E. Berry, H. F. Brinen, R. M. Conner, S. H. Downs, Linn Helander, F. B. Holgate, W. O. Huebner, W. W. Kennedy, J. N. Livermore, R. D. Madison, G. E. McElroy, L. G. Miller, D. W. Nelson, W. A. Pownall, G. B. Priester, C. H. Randolph, T. H. Troller, G. L. Tuve.

Presented at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Muskoka, Ontario, Canada, June 1950.

[1]Exponent numerals refer to Bibliography.



(Reproduced from Reference 2, *Journal of Applied Mechanics*. Used by permission.)

Fig. 1—Schematic representation of flow in elbows:
a. Variation of flow in axial direction
b. Motion in transverse plane of bend outlet

ing flow. These regions are schematically shown in Fig. 1.

The flow in the *core* or central body of fluid is predominantly axial, transverse velocity components being small compared to components parallel to the axis of the duct. The velocity distribution frequently approximates a condition in which the velocity is inversely proportional to the radius of stream line curvature. This central body of fluid may be visualized as the *core* emerging from the boundary layer which is formed by the influence of the elbow in altering the velocity profile of the straight duct.

The *shedding layer* includes the fluid near the duct wall in which the velocity components axially and normal to the wall are small, and the component tangent to the core is large. The peripheral flow in this region is directed toward the inside of the bend as shown in Fig. 1, serving to shed the fluid of lower total energy near the wall.

The two currents of peripheral flow from the shedding layer impinge at the inside of the bend in the *region of eddying flow*. This region is occupied by turbulent fluid of lowest total energy resulting from the sorting of fluid particles according to energy content. Backflow may occur in the eddying region for elbows of small radius ratio. The flow in the shedding layer and its circulation through the core is commonly referred to as *secondary* or *vortex* flow. The presence of eddying flow and these vortex pairs have been established by dye traces,[3] casts,[4] velocity surveys,[1, 5, 6, 7, 8, 9, 10, 11] and photographs.[6, 11, 12, 13]

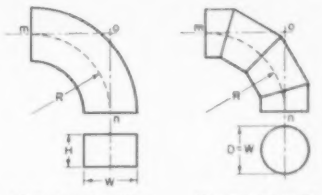
Energy Losses

Losses of available energy occur due to shear stresses at the duct wall and within the fluid itself, not only in the flow at the bend but downstream from the bend in the reforming of the velocity distribution.

A number of attempts[2, 14, 15] have been made to predict energy losses analytically, though only the most important will be mentioned here. Theoretical investigations have been made by Dean[16] and Adler[17] for laminar flow in elbows, however these results cannot be extended to turbulent flow. Results of a qualitative nature were obtained by Nippert[4] who examined the losses due to secondary vortex flow by analogy to shearing stresses in a twisted bar. More recently Weske[2] has presented evidence to indicate that the loss is proportional to the quantity of flow in the shedding layer. Further, he has treated the equation of motion in the shedding layer of elbows in round ducts, and has derived an approximation for the energy loss in terms of radius ratio, the upstream velocity distribution, and the pitch of the secondary flow. Since data are lacking for this pitch, the relation is indicative of trends only.

In the absence of a theoretical treatment which satisfactorily copes with the complexity of flow and the many elbow geometries encountered, it is necessary to resort to the empirical correlation of experimental results.

Several different methods have been employed in presenting ex-



(a) Rectangular Elbow (b) 4 Piece Round Elbow

Fig. 2—Terms defining geometry of elbow

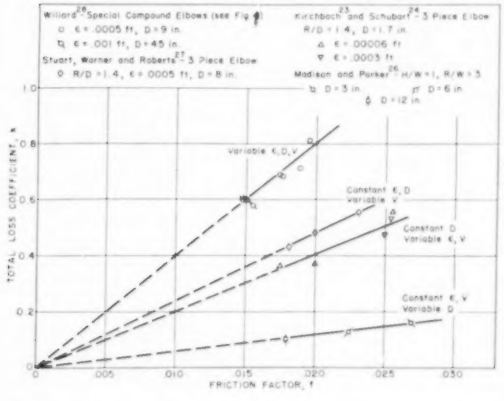

Willard[28] Special Compound Elbows (see Fig. 4)
○ ε = .0005 ft, D = 9 in.
◔ ε = .001 ft, D = 45 in.
Stuart, Warner and Roberts[27] 3 Piece Elbow
◇ R/D = 1.4, ε = .0005 ft, D = 8 in.
Kirchbach[23] and Schubart[24] 3 Piece Elbow
R/D = 1.4, D = 1.7 in.
△ ε = .00006 ft
▽ ε = .0003 ft
Madison and Parker[26] H/W = 1, R/W = 3
◔ D = 3 in. ◩ D = 6 in.
◇ D = 12 in.
Variable ε, D, V
Constant ε, D Variable V
Constant D Variable ε, V
Constant ε, V Variable D
TOTAL LOSS COEFFICIENT, k
FRICTION FACTOR, f

Fig. 3—Examples of linear relationship between *k* and *f*

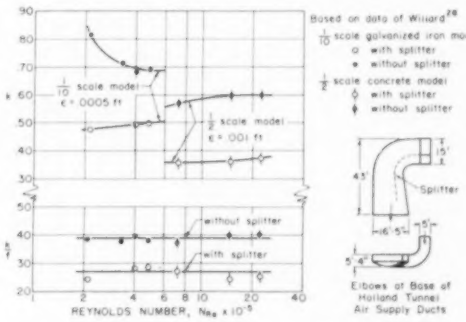

Based on data of Willard[28]
1/10 scale galvanized iron model
○ with splitter
• without splitter
1/2 scale concrete model
◇ with splitter
♦ without splitter
1/10 scale model ε = .0005 ft
1/2 scale model ε = .001 ft
without splitter
with splitter
k/f
REYNOLDS NUMBER, Re x 10⁻⁵
Splitter
Elbows at Base of Holland Tunnel Air Supply Ducts

Fig. 4—Loss data for models of Holland Tunnel elbows, illustrating use of *k*/*f* when size, roughness, and velocity are varied

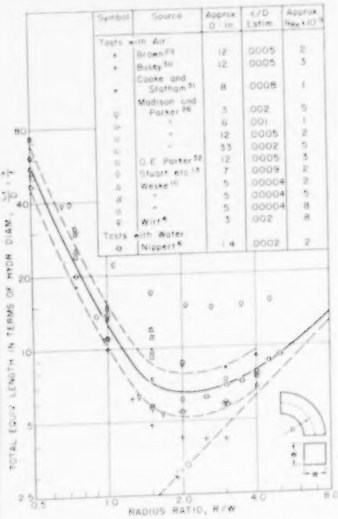


Fig. 5—Loss in total equivalent hydraulic diameters for 90-deg elbows of square cross section

perimental results, so that one of the problems of this survey has been to reduce these data to common terms. Some investigators have deducted from the total pressure loss Δp for the curved portion of duct the loss for a length of straight pipe equal to the length of the bend axis and have termed the remainder $\Delta p'$ the *deflection* or *shock* loss. Use of the term *shock* in this sense and in the description of losses at a sudden enlargement is believed misleading.* The practice of deducting the friction loss for the axial length is not followed in this paper, since the complex nature of the flow makes the friction loss assigned to the axial length entirely fictitious. Furthermore, use of the total loss Δp is more conventional for heating and ventilating practice.

In the empirical approach, it must be borne in mind that the data represent many conditions of flow and several different test methods; no systematic and complete set of data is available.

*In modern fluid mechanics, the term *shock* denotes the compression of fluid from a super-sonic velocity to a sub-sonic velocity.

Empirical Approach

Variables Affecting Loss

Fourteen dimensional variables are known to be significant in fluid flow through conduit bends. Expressed mathematically by the symbols of the nomenclature (see p. 143) and Fig. 2.

$$\Delta p \text{ is a function of } (V, c, \rho, \mu, g, D, R, H, W, \varepsilon, \Gamma, A_1, A_2) \ldots (1)$$

Methods of dimensional analysis suggest the reduction of these variables to dimensionless groups:

$$\frac{\Delta p}{\rho V^2/2g} \text{ is a function of } \left[\frac{\rho V D}{\mu}, \frac{V}{c}, \frac{R}{W}, \frac{H}{W}, \frac{\varepsilon}{D}, \frac{\Gamma}{R}, \frac{A_1}{A_2}\right] \ldots\ldots (2)$$

or

$$k \text{ is a function of } (N_{Re}, M, R/W, H/W, \varepsilon/D, \theta, A_1/A_2)$$

where

k = total loss coefficient of the elbow.

Inasmuch as this paper deals with 90-degree elbows of constant area, the terms for area ratio A_1/A_2 and angle θ are dropped. For the velocities encountered in air conditioning practice, compressibility effects are negligible within a fitting so that the Mach number M need not be considered.

The Friction Factor

In an attempt to further reduce the number of variables and thus to simplify the empirical approach, the possibility was investigated of replacing the relative roughness ε/D and Reynolds number N_{Re} by the friction factor f for straight pipe.

The relation of these factors has been offered by Moody[27] in the form of the equation

$$f = 0.0055\left[1 + \left(20{,}000\,\frac{\varepsilon}{D} + \frac{10^6}{N_{Re}}\right)^{1/3}\right] \ldots\ldots (3)$$

Rouse[28] has shown that for fully developed turbulence in straight pipes, the velocity distribution is dependent only upon the friction factor; it is for the purpose of characterizing the flow at a given combination of N_{Re} and ε/D that the friction factor is introduced. Thus

$$k \text{ is a function of } (f, R/W, H/W) \ldots\ldots (4)$$

It has been established by Weske[10] and by Huebscher[29] that for reasonably smooth ducts the friction factor is independent of aspect ratio up to 8:1. The roughness of an elbow in general corresponds to that for straight ducts, the loss due to elbow joints being included in the loss coefficient k.

It was observed by Abramovich[20], in analyzing the results of several European investigations,[21,22] that the net bend loss coefficient k' varied linearly with the friction factor f for elbows in which backflow was not appreciable. The variation in friction factor for these tests was afforded by varying the velocity and by roughening the inside of the piping with a sand and paint mixture.

Other data have been analyzed in the course of this survey to determine the application of this rela-

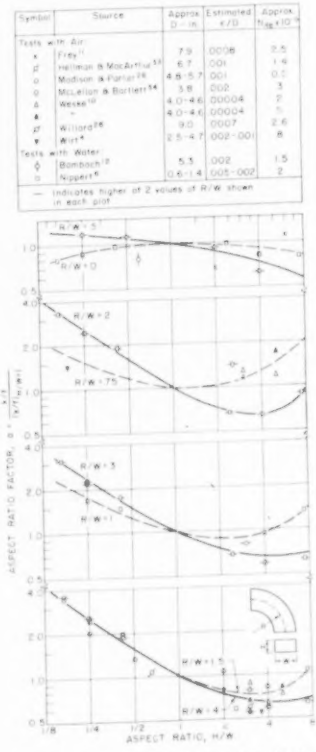


Fig. 6—Aspect ratio factor for 90-deg elbows of rectangular cross section

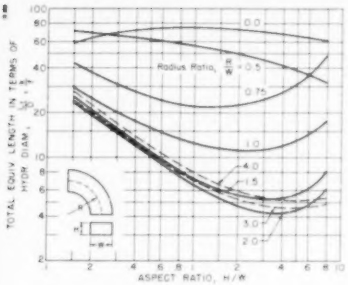


Fig. 7—Loss in total equivalent hydraulic diameters for 90-deg elbows of rectangular cross section

tionship and sample plots are shown in Fig. 3. If the linear relationship of k and f may be assumed to pass through the origin, then the ratio k/f is a constant for a given elbow. Thus an opportunity is offered for further reducing the number of variables for an empirical correlation of data.

Each curve of Fig. 3 is for a different elbow; the various values of the friction factor for each were obtained by changing one or more of the variables ϵ, D, or V as indicated. Size variation is shown by the data of Madison and Parker[5], velocity variation by the data of Stuart, Warner and Roberts[7], and combined effects of variable roughness and velocity by the data of Kirchbach[23] and Schubart[24]. Data of Willard[25] for compound elbows include combined effects of variable size, roughness, and velocity; these tests were made at velocities from 1000 to 7000 fpm on sheet metal and concrete models of elbows at the base of the Holland Tunnel air supply ducts. An illustration of the use of k/f is seen in Fig. 4 where the results for the models tested by Willard[25] are brought together by plotting k/f against Reynolds number.

Equivalent Length

Other data plotted in the manner of Fig. 3 indicate that k/f is constant within about ± 15 percent for the range of friction factors represented in the investigations surveyed. (This will be discussed further in the Appendix*.) The demonstration, that k/f may be considered essentially constant, justifies the assumption frequently made in design calculations that elbow resistance may be expressed in terms of *equivalent length* of straight duct.

The loss due to a fitting may be expressed as $h = k\frac{V^2}{2g}$ and the friction loss of a length of duct L_1 which imposes a resistance to flow equivalent to that of the fitting is $h_1 = f\frac{L_1}{D}\frac{V^2}{2g}$. Equating h and h_1 yields

*Material not essential to the presentation of the correlation will be found in the Appendix, including discussion regarding testing and presentation methods, and comparisons with previous surveys. The Appendix will appear in the ASHVE TRANSACTIONS, Vol. 56, 1950 (to be published); until these are available, mimeographed copies can be secured on written request to the ASHVE Research Laboratory.

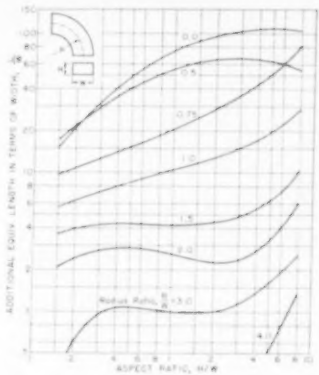


Fig. 9—Loss in additional equivalent widths vs. aspect ratio for 90-deg elbows of rectangular cross section

$$k/f = L_1/D \quad \ldots\ldots (5)$$

or the *total equivalent length in terms of hydraulic diameter.*

Effect of Radius Ratio

If the concept of equivalent hydraulic diameters is adopted, the fourteen variables are reduced to three dimensionless groups which must be dealt with in the empirical correlation of data:

$$k/f \text{ is a function of } (R/W, H/W) \quad \ldots\ldots (6)$$

The usual approach to this problem is to consider the data for the case where one of the groups is constant. Since most of the test work on rec-

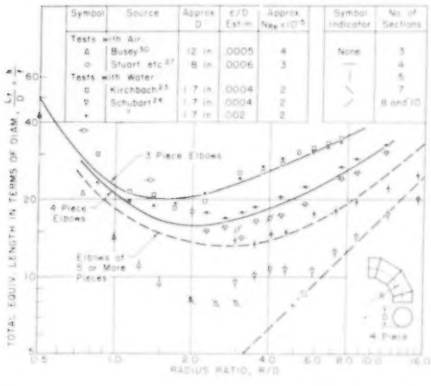


Fig. 8—Loss in total equivalent diameters for 90-deg elbows of round cross section

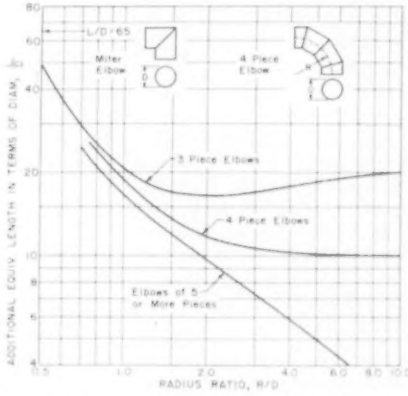


Fig. 10—Loss in additional equivalent diameters for 90-deg elbows of round cross section

tangular elbows has been for those of square cross section, the effect of radius ratio was first investigated at an aspect ratio of unity. These data are plotted in Fig. 5 and include test values from various investigators (References 4, 6, 10, 13, 26, 29, 30, 31, 32).

A zone containing most of the data was established and a mean curve arbitrarily drawn. The zone of Fig. 5 covers values of k/f within ± 20 percent of the mean curve. The line for $k' = 0$ indicates the magnitude of the loss for a straight length of duct l' equal to the curved centerline of the elbow. Aside from errors in experimental technique, the scatter of data may be due to several reasons: differences in approach or discharge conditions, differences in the construction of elbows, inaccuracies in the determination or estimation of the friction factor, and limitations of the equivalent length concept. (See Appendix.)

Effect of Aspect Ratio

Preliminary plots of k/f against aspect ratio for constant values of radius ratio indicated that the scatter of data for different investigators was so great that trends could not be established. Instead, the data of each investigator (References 4, 6, 10, 11, 12, 26, 28, 33, 34) were plotted relative to the loss obtained for an elbow of square cross section. Thus the *aspect ratio factor* a is the ratio of k/f at a given aspect ratio to k/f at an aspect ratio of unity.

$$a = \frac{k/f}{(k/f)_{(H/W)=1}} \qquad (7)$$

Fig. 6 shows the factor a plotted against aspect ratio for constant values of radius ratio. The curves were drawn by eye, giving the greatest weight to the data of Nippert[7] who investigated elbows of aspect ratios ranging from 1/7.5 to 7.5.

Having established the trend of the aspect ratio factor, these values were combined with k/f from Fig. 5 to give the summary plot of Fig. 7. A consistent family of curves is thus obtained for elbows having a finite inside radius. The form of the curve is apparently altered for 0.5 radius ratio by the presence of the sharp inside corner; the elbow at zero radius ratio is a miter elbow, having sharp corners at both the inside and outside.

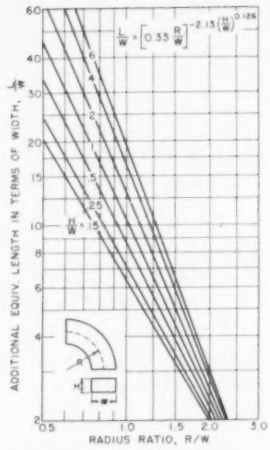


Fig. 11—Loss in additional equivalent width vs. radius ratio for 90-deg elbows of rectangular cross section

Elbows of Round Cross Section

Many investigations have been made on losses in elbows of round cross section, covering radius ratios higher than those tested with rectangular section. Data are shown in the Appendix for losses in pipe bends, as distinguished from elbows built up of straight sections. Geometries of built-up elbows have been expressed in terms of radius ratio and their loss data plotted in Fig. 8. The curves for three- and four-piece elbows were drawn by eye as the best line through the data. Scatter of data for elbows of five or more sections was such that the curve for pipe bends (established in the Appendix) was reproduced as representative of elbows of more than four pieces.

Practical Interpretation of Data

Additional Equivalent Length in Terms of Width

In the calculation of elbow losses for duct design, use of total equivalent length in terms of hydraulic diameters L_e/D necessitates the determination of the hydraulic diameter D for each elbow. Thus, it is believed more convenient for the design of rectangular duct systems to have the total equivalent length of duct expressed in terms of width W. The number of total *equivalent widths* is then

$$\frac{L_e}{W} = \frac{L_e}{D} \cdot \frac{D}{W} = \frac{L_e}{D}\left(\frac{2}{1 + W/H}\right) \qquad (8)$$

by the definition of hydraulic diameter in terms of aspect ratio.

It is convenient in laying out duct systems to measure straight runs of duct to the intersection of their centerlines. When measurements are made in this way the *additional equivalent length* of duct necessary to represent the energy loss is less than the *total* equivalent length by the length m-o-n of Fig. 2. Thus the *additional equivalent length* in terms of widths is

$$\frac{L}{W} = \frac{L_e}{W} - 2\frac{R}{W} \qquad (9)$$

Through Equations 8 and 9, the curves of Figs. 7 and 8 have been converted to additional equivalent

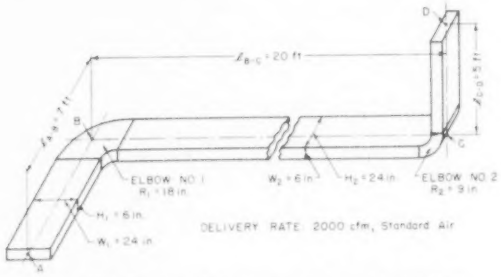


Fig. 12—Portion of duct system for sample problem

length and are replotted in Figs. 9 and 10, respectively. The loss for a miter elbow is also shown in Fig. 10; data[6, 24, 27, 28] used in establishing this value are consistent within ± 10 percent.

Fig. 11 is offered for use where odd radius ratios are encountered. These curves correspond to the exponential relation,

$$\frac{L}{W} = \left[0.33 \frac{R}{W} \right]^{-2.15 \left(\frac{n}{w} \right)^{0.126}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (19)$$

and approximate a cross-plot of Fig. 9 within about ± 20 percent.

Illustrative Problem

Use of Fig. 11 is illustrated by the following problem.

Given the portion of a duct system shown in Fig. 12, it is required to determine the pressure loss between points A and D. Air at standard conditions is being supplied at the rate of 2000 cfm in a 6 by 24-in. galvanized duct of average construction. Elbows Nos. 1 and 2 have centerline radii of 18 and 9 in. respectively.

For elbow No. 1 the radius ratio is $\frac{R_1}{W_1} = \frac{18}{24} = 0.75$ and the aspect ratio is $\frac{H_1}{W_1} = \frac{6}{24} = 0.25$. The additional equivalent length for elbow No. 1 in terms of W is obtained from Fig. 11: $(L/W)_1 = 11.5$. Thus $L_1 = 11.5 \times 24/12 = 23$ additional equivalent feet. Similarly for elbow No. 2, the radius ratio is $\frac{R_2}{W_2} = \frac{9}{6} = 1.5$ and the aspect ratio is $\frac{H_2}{W_2} = \frac{24}{6} = 4.0$; Fig. 11 gives $(L/W)_2 = 6$, so $L_2 = 6 \times 6/12 = 3$ additional equivalent feet.

The total length of the straight runs from A to D is $l = l_{A-B} + l_{B-C} + l_{C-D} = 7 + 20 + 5 = 32$ ft and the additional equivalent length due to the elbows is $L = L_1 + L_2 = 23 + 3 = 26$ ft. Thus the equivalent length of the system from A to D is $l + L = 32 + 26 = 58$ ft of 6 by 24-in. duct.

The diameter of a circular duct, equivalent in friction and capacity to this rectangular duct, is 12.4 in. as given by the table of circular equivalents in THE GUIDE[29]. At a delivery rate of 2000 cfm, the ASHVE Friction Chart[29] gives a loss of 0.6 in. of water per 100 ft of 12.4 in. diameter duct. Thus the loss from A to D is $0.6 \times 58/100 = 0.348$ in. of water.

Comments

An exact correlation of existing data is practically impossible owing to differences in test methods, flow conditions, and elbow construction. No single investigation has covered the entire field of flow conditions and elbow geometry and construction. Each has instead, been confined to a relatively limited range of application. The effects of Reynolds number and upstream velocity distribution on the energy loss in elbows have not been accurately established in this survey because of the inadequacy and inconsistency of existing data.

It is belived that the curves presented in this paper for energy losses in 90-deg duct elbows are as accurate as may be deduced from the data presently available. If data of greater accuracy are desired, a comprehensive experimental program would seem necessary.

The survey should be extended to cover losses in vaned elbows, compound elbows, and elbows involving change of area.

Acknowledgment

The author acknowledges with thanks the help of all those who cooperated in assembling information and the suggestions given by his colleagues of the ASHVE Research Laboratory staff.

Nomenclature

Dimensional Terms

A_1 and A_2 = area of bend at entrance and exit, respectively; square feet.

c = velocity of sound in the fluid, feet per second.

D = duct hydraulic diameter, ft (or inches where noted); $D = 4 \times \frac{\text{area}}{\text{perimeter}}$

For rectangular ducts: $D = \frac{2W}{1 + W/H}$

For round and square ducts: $D = W$.

g = acceleration of gravity, feet per (second) (second).

h = total head loss due to a fitting, feet of fluid flowing; $h = \Delta p/\rho$.

H = duct dimension perpendicular to plane of bend, feet (see Fig. 2).

l = length of duct, feet.

l' = curved centerline length of elbow, feet (for 90 deg elbows: $l' = \pi R/2$).

L = length of duct, in addition to length of m-o-n of Fig. 2, imposing resistance equivalent to that of a given elbow, feet; $L = L_1 - 2R$.

L_1 = total length of duct imposing resistance equivalent to that of a given elbow, feet.

Δp = total pressure loss due to a fitting, pounds per square foot.

$\Delta p'$ = net pressure loss due to a fitting, pounds per square foot.

R = centerline radius of bend, feet (see Fig. 2).

V = velocity of fluid, feet per second.

W = duct dimension in plane of bend, feet (see Fig. 2).

ϵ = absolute roughness of duct system, feet.

μ = viscosity of fluid, pounds per (foot) (second).

ρ = density of fluid, pounds per cubic foot.

Dimensionless Terms

a = aspect ratio factor; the ratio of k/f at a given aspect ratio to k/f at unity aspect ratio; $a = \frac{k/f}{(k/f)_{H/W=1}}$

f = friction factor in equation: $h_f = f \frac{l}{D} \frac{V^2}{2g}$

H/W = aspect ratio.

k = total loss coefficient of elbow in equation: $h = k \frac{V^2}{2g}$

k' = net loss coefficient of elbow; $k' = k - f\, l'/D$.

L/D = additional equivalent length in terms of hydraulic diameter.

L/W = additional equivalent length in terms of width.

L_1/D = total equivalent length in terms of hydraulic diameter; $L_1/D = k/f$.

L_1/W = total equivalent length in terms of width.

M = Mach number; $M = V/c$.

N_{Re} = Reynolds number; $N_{Re} = \frac{\rho D V}{\mu}$

R/W = radius ratio.

ϵ/D = relative roughness.

θ = angle of bend in radians; $\theta = l'/R$.

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DISCUSSION

C. M. Ashley, Syracuse, N. Y. (Written): The author is to be commended upon the thoroughness with which the correlation of the available information on this subject has been made and the general excellence of the presentation. Of particular interest is the demonstration of the relationship between the friction factor and the energy loss in velocity head.

It is unfortunate that the main body of the paper did not include a discussion of the effect of approach and downstream conditions on the elbow efficiency since it is important to emphasize the possible adverse effect of two elbows in close succession or of other disturbing elements upstream or downstream.

It is evident that there is still room for a definitive test program and it is believed that this analysis has laid a suitable ground work for such a program.

R. D. Madison, Buffalo, N. Y. (Written): A survey of this type is very difficult because most of the original data are not available and reference must be made to abbreviated reports. The author has done an excellent job in comparing the available material and pointing out values that are reasonable to use. When this work is extended to cover elbows with splitters and non-uniform elbows with turning vanes, a further contribution to the designer of duct systems will have been made.

Unfortunately the paper* is too long to be published in its entirety in the

*The complete paper will be published in the ASHVE Transactions, Vol. 56, 1950).

JOURNAL. Much of the available material has been on the basis of loss in percent of velocity pressure; data in these terms are shown in Figs. A2 and A3 of the Appendix. As has been pointed out by the author, the idea of equivalent length or equivalent additional length serves very well for comparing elbows of the low loss type. When it comes to elbows having $\frac{1}{4}$ to 1 velocity head loss, the velocity head loss method is more exact, since the effect of size becomes negligible. Also the effect of velocity is minimized on this comparative basis. However, it is to be hoped that low loss elbows will be used where possible, and the method outlined in this paper becomes a logical solution to presentation of elbow losses.

CYRIL TASKER, Cleveland, Ohio, cited the paper as an example of literature research which is necessary in preparation for test work to be conducted. He discussed the sources of the information and object of the investigation.

F. C. HOOPER, Toronto, suggested that since the dimensional approach had been used in developing the formulas for duct loss, it should be possible to obtain energy losses for elbows having angles other than 90 deg by inserting another dimensional factor in the formulas.

AUTHOR'S CLOSURE: In response to Mr. Ashley, the information available on the effects of approach and downstream conditions is not wholly conclusive. There remains need for a comprehensive experimental investigation if these effects are to be definitely established for the range of such conditions encountered in practice.

Answering Mr. Madison, the extension of the survey to losses in vaned elbows and special elbows should prove very interesting. It has been established by the data of several investigators that a substantial saving in loss can be realized by the installation of vanes; however the problem of correlation of these data becomes more difficult due to the number of additional variables introduced by tests on vanes of different form and spacing in different elbows.

The survey showed that the loss for a given elbow may be reasonably generalized by either the equivalent length concept or the percent of velocity head method. The equivalent length concept was chosen for this presentation since the author believed that it was the more consistent over a wide range of elbow forms and that the concept was the simpler in application to design.

As Mr. Hooper suggests, losses in elbows other than 90 degrees may be handled by retaining the term l'/R in Equation 2 and subsequent dimensionless relations. In the interest of simplicity, this was not done for this presentation; however, the usual assumption of loss being proportional to the angle of bend is believed within the accuracy of the correlation.

PROF. MILLER HONORED AT LUNCHEON

Prof. William T. Miller, of the School of Mechanical Engineering at Purdue University, Lafayette, Ind., was the honored guest at a pleasant surprise luncheon on Thursday, July 20, at the Memorial Union when a small group of his friends gathered to notify him that arrangements had been made for an oil painting of his portrait. The portrait which will be done by Miss Marie Goth, noted Indiana portrait painter, at her studio in Brown County, will be presented to the University as a token of the esteem of Professor Miller's friends over the state and country and associates on the campus.

Officials of the *Indiana Sheet Metal and Warm Air Heating Contractor's Association*, with which Professor Miller has worked closely for many years, as he is professor of heating and ventilating engineering, originated the move for the portrait. William Garber, Indianapolis, president of this organization, made the announcement to Professor Miller of the portrait idea and Vice Pres. R. B. Stewart of the University spoke on behalf of the school, expressing the appreciation for this honor to be conferred on Professor Miller and the service that had merited this recognition.

Prof. William T. Miller
West Lafayette, Ind.

"We hope that the high type of service to his fellow men as exemplified by Professor Miller in his constant contact with students over 22 years, will continue to be the force back of the University and the work of its staff during all the years ahead," said Dr. Stewart.

Frank E. Anderson, Terre Haute, secretary of the organization sponsoring the portrait, is serving as treasurer of the fund to which scores of former students, faculty members, and men in industry have contributed. Contributions, which were solicited unknown to Professor Miller for some months, are still coming in, Mr. Anderson reported, and any surplus will go into a scholarship fund.

Others at the luncheon besides those named were Prof. Merle McClure, who presided; I. W. Cotton and S. E. Fenstermaker, Sr., Indianapolis, representing the Indiana Chapter of the ASHVE; A. V. Hutchinson, New York, executive secretary of ASHVE; T. B. Speaker, West Lafayette, a director of the organization sponsoring the portrait; S. E. Fenstermaker, Jr., Indianapolis, president of the *Indiana Air Conditioning Council;* Prof. Fred Morse, a colleague of Professor Miller; and T. R. Johnston, director of information for the University.

JOURNAL SECTION

A Simple Heated-Thermocouple Anemometer

By H. B. Nottage*, Cleveland, Ohio

This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at 7218 Euclid Ave., Cleveland 3, Ohio

SUMMARY — Construction features are described for a unit employing a heated differential thermocouple to yield remote readings of air velocity and having a second thermocouple for air temperature. Design principles are pointed out and shown to be quite flexible in application. The method of calibration and the nature of the calibration data are noted. For highest precision the slight influences of air temperature and humidity upon the anemometer readings may be included.

A SIMPLE yet reliable instrument for measuring low air velocity is essential in research on air distribution in rooms. The heated-thermocouple anemometer is one type of remote-reading instrument which has shown promise for obtaining time-mean velocity data. Preliminary experience is reported here for units which have been built and calibrated at the ASHVE Research Laboratory for the velocity range 30 to 1500 fpm. These instruments are currently being used in the long-range program[1,2] on room air distribution under guidance of the Technical Advisory Committee on Air Distribution†. Inherent flexibility of design and application of the anemometers, together with inexpensive construction and adaptability to standard indicating or recording devices, are factors which favor diverse practical use of such instruments.

Heated-Thermocouple Principles and Theory

The temperature difference between an electrically heated thermojunction and a differentially-connected unheated thermo-junction similarly placed in a fluid stream can be related to the velocity by calibration.[3,4] Some commercially-available anemometers employ this principle. One non-directional variation developed initially for cold-storage research employs the transient cooling of a small heated sphere.[5]

The anemometer described in this paper is shown diagrammatically in Fig. 1. The small streamlined tip contains an electrical heating element wound about a thermocouple junction. The unheated junction is exposed directly to the air stream, and mounted opposite thereto is an independent thermocouple for measurement of air temperature. The heated tip is supported on the four lead wires in order to favor maximum convective heat loss and to avoid appreciable disturbance of the fluid stream.

The chosen method of operation is to maintain a constant rate of heat generation in the tip and to relate the differential thermocouple electromotive force e to the velocity. (By using wire with a negligibly small change of resistance with temperature, a constant heating current will establish a constant I^2R heat generation rate for the intended range of use. A practical caution, however, is that the resistance element should be adequately aged by prolonged heating before using the anemometer, otherwise the resistance R may drift during initial use.) Advantages of the method are: (1) ease of use with several heating elements connected in series with the same constant current under remote control, and (2) convenience of remote emf measurements with speedy automatic potentiometers.

The physical principle of operation is based on a heat balance on the heated tip. Heat generation rate is equated to the convection, radiation and conduction heat loss rates:

$$q_{gen} = q_{conv} + q_{cond} + q_{rad} = \text{constant} \quad \ldots\ldots\ldots\ldots\ldots (1)$$

The rate of heat conduction from the tip into the base along the lead wires, q_{cond}, can be made entirely negligible by proper design. The method used here is to treat the wires as long thin fins[6] and make them long enough to lose by convection and radiation substantially all of the heat which they conduct away from the tip.

Radiation loss to the surroundings, q_{rad}, can be minimized by: (1) taking advantage of the natural bright metallic finish of the tip and wires, (2) keeping the surface area of the heated portions small, and (3) avoiding large temperature differences to surrounding objects and calibrating in an environment similar to that intended for use. Although conditions can be visualized

*Research Associate, ASHVE Research Laboratory. Member of ASHVE.
Exponent numerals refer to References.
†Personnel: Ernest Szekely, *chairman*; N. E. Berry, H. F. Brinen, R. M. Conner, S. H. Downs, Linn Helander, F. B. Holgate, F. J. Kurth, J. N. Livermore, R. D. Madison, G. E. McElroy, L. G. Miller, D. W. Nelson, W. A. Pownall, G. B. Priester, C. H. Randolph, T. H. Troller, G. L. Tuve.
Presented at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Muskoka, Ontario, Canada, June 1950.

where q_{rad} would not be negligible, the simple theory of this paper will postulate negligible radiation.

The convection term, q_{conv}, is thus the only heat loss remaining in Equation 1 for the case being considered. The object losing heat is the tip with attached *fins* in the form of the lead wires. (The two copper lead wires for the heating element contain a small I^2R heat generation themselves, but this superposition does not affect the simplified theory.) Since the average unit convective conductance for the tip and the wires separately would vary in substantially the same manner with stream velocity[7], a single velocity factor should serve to express q_{conv}. The following limitations are necessary in order to apply the simplified theory: (1) anemometers are to be used in air only, (2) moderate tip-to-air temperature differentials are to be observed so as to minimize free convection influences; (3) anemometers are to be individually calibrated so that dimensional factors will be included in the calibration results; and (4) linear relation is postulated between differential thermocouple voltage and tip-to-air temperature difference.

The simple equation which follows from the given conditions (see Appendix for derivation) is:

$$\left(V\rho/\rho_s\right) = K\left(\frac{1}{e(C/C_o)}\right)^n \qquad \ldots\ldots\ldots\ldots (2)$$

where

V = stream velocity, feet per minute.

ρ = stream density, pounds per cubic foot.

ρ_s = standard air density of 0.075 pounds per cubic foot.

e = differential tip-to-air thermocouple reading, millivolts.

n = an exponent to be established by experiment.

K = an instrument constant to be established by experiment but which can be varied for any given anemometer by changing the heating current.

C/C_o = a correction factor for the very slight influence of air temperature and humidity, as explained in the Appendix.

It should be noted that changes of K to accommodate different velocity ranges allow the anemometer differential voltage to be altered conveniently. The theory as given requires the stream temperature to be the same approaching both the heated tip and the unheated junction; if this is not the case, the prevailing stream temperature profile must be established and the observed value of e corrected accordingly.

The factor C/C_o is nearly unity and may be neglected in many practical cases.

The anemometer form shown in Fig. 1 is intended for use in rather large spaces and with directed air movement. Variations in form are possible to suit other applications.

Anemometer Construction

Present construction will be outlined, but future improvements due to experience in use are anticipated.

1. *Base:* A cord-end plug which snaps into a radio socket and makes thermocouple connections; a glass tube with metallic cross-arm to support the thermo-junction wires; the assembly molded together with hard-setting cement. Heater leads go out through the side of the base to separate binding posts.

2. *Thermocouples:* Made of copper-constantan duplex-insulated wire of 24 gage. Baked-on varnish over insulation will provide excellent stiffness for self support.

3. *Heating circuit:* Lead wires to tip are of 24-gage copper. Heating element is made of 30-gage insulated (varnish-impregnated) constantan wire wound about the thermo-junction.

4. *Heated Tip:* Four bare 24-gage wires entering tip are positioned and insulated by use of a tiny cylindrical piece of micarta through which four No. 75 holes are drilled lengthwise and which is strengthened by a few turns of reinforcing wire wound around the outside. Electrical insulation between the thermocouple and heating circuits at the thermo-junction is obtained by two coats of carefully-applied and baked-on water glass. The ovate-shaped metal sheath for the tip is made of solder which is melted and then cast about the entire tip assembly in a metallic mold. Lead wires to the tip are formed into the spiral cones and cemented in place in the end of the glass support tube.

The construction described has proved to be economical and practicable for the purpose intended. The heating current and heater resistance are chosen to give some desired limiting temperature differential with the anemometer placed tip downward in a large quieting box to obtain natural convection. (The unit of Fig. 1 happened to have a heater resistance of 0.31 ohms, and the maximum current used was 1.7 amperes.)

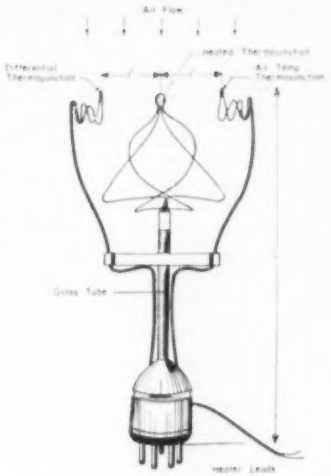

Fig. 1—Heated-thermocouple anemometer

Many variations are possible. Use of finer wires and a very small tip will constitute a sound improvement by aiding convection, although with fine wires an auxiliary support may become necessary; also smaller tips require more skill to build and have a lessened thermal capacitance.

The present design is intended for use in free-space regions, where the velocity variation across the distance of an inch or two is negligible. More compact assemblies could be built for use in regions of noticeable velocity gradients and near surfaces.

The present design is also intended for use in head-on flow, or at least in flow which is within roughly ± 30 deg of being head-on. Yaw-angle calibrations have been made. Variations in designs are possible to produce an instrument which will be still more non-direc-

tional over a quite large range of yaw angles.

Use of other thermocouple materials would yield a greater electromotive force per degree of temperature differential, and this in turn would favor operation at low rates of heat generation.

The present anemometers were designed for use with automatic potentiometers indicating millivolts. With more sensitive means of emf measurement, operation at lower rates of heat generation would be aided.

Among other possible variations is the use of resistance-thermometer elements in place of a thermocouple. This has, in effect, been employed by Schmidt.[7]

Calibration

Lacking a reliable standard of comparison for velocity the anemometers have been calibrated through exposure to a known velocity under conditions representative of intended use, namely, in a free jet.

For velocities above 300 fpm a standard Pitot tube and a sensitive micromanometer were employed to establish the known reference velocity. For lower velocities a rather lengthy fit-and-try method was necessary; in this, velocity profiles were taken with an anemometer traversing across the jet outlet and the calibration established so that the mean of the velocity profiles agreed with flow rate measured by a standard orifice in the jet air supply system. Thorough double-checking was the rule in all of this work.

The type of calibration obtained is shown in Fig. 2, wherein C/C_o has been taken as unity. Equation 2 is substantiated thereby, with the lower heating current favored for the very low velocities. Measurements below about 30 fpm are below the range of application of this instrument. A slight influence of free convection and radiation is noticeable below 50 fpm, and while this could have been removed by using a still lower heating current, such a move was not deemed necessary and would have had the disadvantage of further lowering the emf at the automatic potentiometer.

Data on the yaw-angle response are shown in Fig. 3. $(V\rho/\rho_o)_\alpha$ denotes the velocity reading for a given yaw angle and $(V\rho/\rho_o)_o$ is the reading for head-on flow. Accepting a ± 5 percent reading shift as being tolerable, it follows that the anemometers may be out of alignment with the air stream by ± 25 deg to ± 30 deg with no serious consequences, depending upon the velocity being measured. The data also illustrate the influence of the thermojunctions in shielding the air flow from the heated tip at the greater yaw angles.

Calibration data were checked with air temperatures varying from 40 to 120 F and for humidity ratios from 0.002 to 0.016 (lb vapor) per (lb dry air). The density factor ρ/ρ_o and the correction factor C/C_o were found sufficient to yield a single curve for the range of air states encountered.

Recordings of the thermocouple differential voltage in the far regions of a jet have indicated that the anemometer responds adequately to low-frequency low-velocity pulsations, such that both time-mean data and a measure of the pulsation range may be obtained.

Conclusions

As a result of the investigation it may be concluded that:

1. The heated-thermocouple anemometer, combined with an air-temperature thermocouple, is a simple and useful tool for room air distribution research.

2. Many design variations are possible beyond the simple unit described herein. These offer promise for diverse uses in air distribution problems.

Acknowledgment

Full credit is due Prof. L. G. Seigel of Case Institute of Technology for having given freely of his earlier experience with heated-thermocouple anemometers when the current ASHVE project was being planned.

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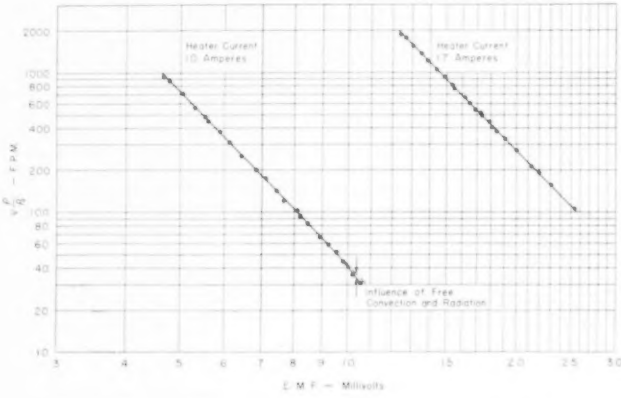
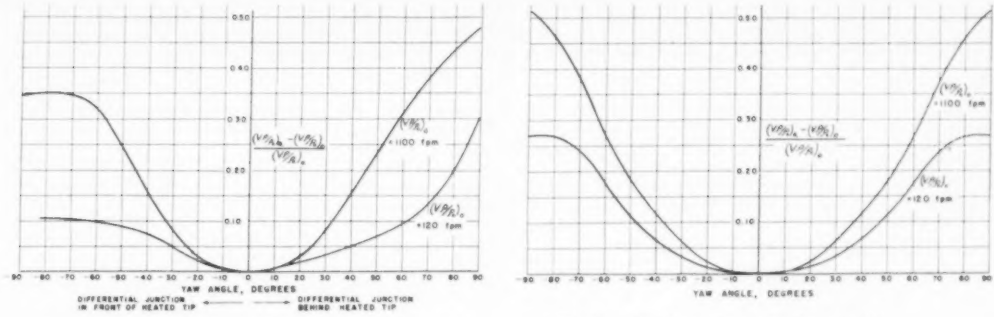


Fig. 2—Sample anemometer calibration curves for $C/C_o = 1$


0.50
0.40
0.30
0.20
0.10
$\frac{(V\rho/\mu)_h - (V\rho/\mu)_o}{(V\rho/\mu)_o}$
$(V\rho/\mu)_o$ +1100 fpm
$(V\rho/\mu)_o$ +120 fpm
-90 -80 -70 -60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90
YAW ANGLE, DEGREES
DIFFERENTIAL JUNCTION IN FRONT OF HEATED TIP
DIFFERENTIAL JUNCTION BEHIND HEATED TIP

(A) Yaw in plane defined by the stem and the line of the three junctions

(B) Yaw in plane perpendicular to (A)

Fig. 3—Yaw characteristics of heated-thermocouple anemometer

6. *Heat Transmission*, by W. H. McAdams (McGraw-Hill Book Co., New York, Second Edition, 1942, p. 231).

7. See Chapter VIII of reference 6.

8. Turbulente Ausbreitung eines Stromes erhitzter Luft, by W. Schmidt (*Zeitschrift fur angewandte Mathematik und Mechanik*, Vol. 21, 1941, p. 351).

APPENDIX

Derivation of Equation 2 for Anemometer Performance

Adopting the simplifications discussed in the paper Equation 1 becomes

$$(h_t A_t + h_w A_w \eta)\ (t_t - t_o) = q = \text{a constant} \quad \ldots\ldots (A\text{-}1)$$

where

h_t = mean unit convective conductance for the tip, Btu per (hour) (square foot) (Fahrenheit degree).

h_w = mean unit convective conductance for the lead wires, Btu per (hour) (square foot) (Fahrenheit degree).

A_t = tip surface area, square feet.

A_w = wire surface area, square feet.

η = fin effectiveness[a] of the lead wires, dimensionless.

t_t = tip temperature, Fahrenheit degrees.

t_o = stream temperature, Fahrenheit degrees.

q = electrical heat generation rate, Btu per (hour).

For the application intended, the unit convective conductances are postulated to be functions of the physical properties of the air and the respective Reynolds numbers. In these Reynolds numbers the geometrical factors are constant for any one anemometer. This leaves the conductances dependent upon the mass velocity of the air stream and the two physical properties, viscosity and unit heat capacity. Taking ρ_o as a fixed standard density, the mass velocity may be expressed as $V\rho/\rho_o$.

The fin effectiveness of the wires varies somewhat with the conductance h_w or, in turn, primarily with $V\rho/\rho_o$. While a constant ratio of h_t to $h_w\eta$ would not be strictly expected for all velocities, the simplest supposition would be that such a constant ratio prevailed; let this be postulated subject to experimental validation, and call the ratio C_3. Departures from this assumption would be expected to be most noticeable at low velocities. The common mode of expressing the convective conductance in terms of the Reynolds number (over a limited range) indicates an expression of the form

$$\frac{h_t}{c_p\left(\frac{V\rho}{\mu\rho_o}\right)^a} = C_2\left(\frac{V\rho}{\mu\rho_o}\right)^a \quad \ldots\ldots (A\text{-}2)$$

where

C_2 = an empirical dimensional constant.

a = an empirical constant, dimensionless.

c_p = unit heat capacity of moist air, Btu per (pound) (Fahrenheit degree).

μ = absolute viscosity of moist air, (pound) (second) per (square foot).

A further assumption is that within the application intended the slope of the curve relating temperature difference and thermocouple electromotive force is nearly constant and therefore may be taken as the average derivative,

$$\left(\frac{dt}{de}\right)_{a+z}$$

where the subscript denotes the slope at the average of the air temperature (sensed by the unheated anemometer junction) and the heated-tip temperature. This slope may be calculated as a function of average temperature for the particular thermocouple wire involved.

With the substitutions given, Equation A-1 becomes

$$C_2\left(\frac{V\rho}{\mu\rho_o}\right)^a \left(c_p \frac{V\rho}{\rho_o}\right)(A_t + C_1 A_w)\left(\frac{dt}{de}\right)_{a+z} e = q = \text{a constant} \quad \ldots\ldots (A\text{-}3)$$

Combining all constants, including the surface areas as constant factors for any one anemometer, a convenient calibration relationship follows from a plotting of

$$\left(\frac{V\rho}{\rho_o}\right) \text{ vs. } e(C\ C_o)$$

where

$$C = c_p \mu^a \left(\frac{dt}{de}\right)_{a+z} \quad \ldots\ldots (A\text{-}4)$$

The factor C is evaluated with the air properties taken at the average of the unheated-tip (or air) and heated-tip anemometer temperatures and for the prevailing humidity ratio.

The factor C_o is taken as a *reference value of C* for some temperature and humidity ratio in the middle of the intended range. This makes (C/C_o) nearly unity, such that it may be neglected if desired.

The exponent a may be determined from a log-log plotting of the relationship

$$(V\rho/\rho_o) = \frac{\text{constant}}{(eC)^{\frac{1}{a+1}}} \quad \ldots (A\text{-}5)$$

In practical use a family of curves giving C/C_o as a function of the average of the heated and unheated-tip temperatures and the humidity ratio will expedite the reduction of data.

For the anemometers used at the ASHVE Research Laboratory the magnitude of C/C_o is within the maximum limits of 0.978 and 1.013 over the range of air states noted. This factor, however, brings all calibration and calibration-check velocity data together within a probable tolerance of approximately ± 5 percent. Note, however, that this tolerance applies to ideal or calibration conditions and need not be representative of all conditions of use.

DISCUSSION

ELLIOT GODES, New York, N. Y. (WRITTEN): The author must be congratulated upon his interesting contribution. Of particular interest and value is the fact that errors due to ambient temperature changes were evidently reduced to a minimum.

About four years ago the company with which I am associated developed, built and tested two instruments based upon the same general principles, but different in construction. One of these instruments had five, the other had 12, sensitive elements. The results obtained, however, were not entirely satisfactory for the following reasons.

1. Difficulty in obtaining uniformity of multiple heated thermocouples.
2. Excessive directional effect of air flow on velocity readings.
3. Excessive effect of ambient temperature on readings.
4. Slow response.

Far more useful results were achieved by development of instrumentation based upon the principle of the heated resistance thermometer, although the main reason for switching to this principle was the desire to obtain a direct reading instrument with higher temperature accuracy.

In the heated-thermocouple anemometer described, a way has evidently been found to minimize the ambient temperature effect and to obtain an adequately speedy response at the expense of a decided reduction of sensitive element mass and structural sturdiness. From Fig. 1 it is difficult to believe that the unit could stand the impact of velocities up to 2000 fpm, head-on or otherwise. Probably it would be advisable to use more conventional instruments for velocities of these magnitudes, particularly if they are as clearly directional as those measured by this anemometer.

Another point to be considered is the difficulty in reading the very small variations in electromotive force caused by considerable differences in air velocities. Thus, a variation of 0.1 millivolt may correspond to as much as the difference between 430 and 1000 fpm for a 1 ampere heater current or the difference between about 720 and 1000 fpm for a 1.7 ampere heater current. It is, therefore, necessary to obtain readings with an accuracy of at least 0.01 millivolt. The original reading shift is said to be within ±5 percent and any errors in converting millivolt readings into velocities would have to be added to the error of the instrument.

In view of the required elaborate measuring equipment and the time consumed for taking and converting indirect readings, this degree of assured accuracy must be considered to be low.

It is, therefore, hoped that the ASHVE Research Laboratory will continue this development work and particularly that it will also investigate the possibilities of an instrument having a still lower effect of air flow direction on the reading (so as to permit determination of turbulent air motion) and capable of handling multiple sensitive elements without sacrificing any of the desirable features of the present anemometer.

LINN HELANDER, Manhattan, Kans., asked the author to explain the effect of rapid fluctuations of temperature upon the instrument.

RAYMOND MANCHA, Pittsburgh, Pa., asked whether the direction of air flow could be obtained with the instrument.

D. D. WILE, Los Angeles, Calif.: Mr. Nottage's paper is particularly valuable as an analysis of the various factors that influence the operation of this type of instrument. As stated by the author, the design is subject to wide modification.

Some years ago the writer constructed several types of heated thermocouple anemometers for measuring air motion over thermostats used to control room temperature. One of these anemometers used in conjunction with a portable microammeter was operated from two small flashlight batteries and had a measuring tip no larger in diameter than an ordinary match. This instrument was very successful in measuring air currents from 20 up to 500 fpm.

AUTHOR'S CLOSURE: With thanks to the discussers, it is pertinent to point out that the paper was intended to bring out physical principles and not to *solve* the anemometer problem.

In reply to Mr. Godes, the unit described was developed for a particular laboratory use and does not compete with anemometers intended for field service. Accessory equipment is not elaborate but it is not readily portable.

Adoption of a thermocouple was dictated by the availability of automatic recording potentiometers in the stock of laboratory instruments. Moreover, these potentiometers forced a compromise by requiring millivolts, although the design analysis indicated the superiority of operating in the *microvolt* range. Use of thermocouple materials having a higher *emf* per unit of temperature difference than copper and constantan also was desired from design calculations, but again a compromise was made. Performance has been satisfactory despite these compromises.

Recent marketing of small, highly compact and standardized resistance-thermometer elements, in combination with automatic recording instruments, is worthy of note by interested persons.

The unit described actually was designed for the range 30 to 800 fpm. The high range has not been used and was noted primarily as a demonstration of principle.

The change in *emf* per unit change in velocity may be controlled in design. Basic dependence upon convective heat transfer, combined with recognition of the billowing, pulsing and wandering nature of free air movement, indicated a practical limit to desirable response sensitivity. It is not claimed, however, that the design described has reached this limit.

The unit has been used up to 3000 fpm. The structure is quite rugged.

Refinements of accuracy are attainable, but then the device would pass out of the *simple* classification.

Directional response is controllable in design. A non-directional instrument was not sought. For the application being made, velocity is considered to be a vector quantity, and direction is measured by other means which remain for future reporting.

Answering Professor Helander, for a true study of rapid fluctuations it is necessary to consider elaborate and expensive instrumentation, as represented by the hot-wire anemometers which have been highly developed in aerodynamic laboratories.

For low-frequency, low-amplitude pulses, the effects of temperature are contained in the calibration relationship giving $(V\rho/\rho_o)$ *vs.* $(e\ C/C_o)$.

For use in traversing non-isothermal flow, simultaneous records of the differential *emf* and the air temperature are planned. This is one reason why the instrument carries its own air-temperature thermocouple.

With reference to Mr. Mancha's question, the unit described is not, in itself, suitable as a direction indicator.

Mr. Wile has nicely emphasized the appealing flexibility of the basic principles.

NEW OFFICERS ANNOUNCED BY JOHNSON SERVICE

Johnson Service Co., Milwaukee, has elected four new officers as follows: A. J. Otto, vice president; R. J. Murphy, vice president and treasurer; J. R. Vernon, secretary; and L. V. Zacharyasz, assistant secretary and assistant treasurer.

Honored by Life Membership

HAROLD L. ALT, Baltimore, Md.—Mechanical engineer, formerly of New York, N.Y. Mr. Alt was born in Rochester, N. Y., in 1885, receiving his education in Rochester schools and graduating from Rochester Athenaeum and Mechanics Institute.

He received his drafting experience with Stromberg-Carlson Telephone Mfg. Co., Rochester, Westinghouse Church Kerr Co. and N. Y. Edison Co., both of New York. He joined Anderson, Meyer and Co., Ltd., Shanghai, China, as chief draftsman in 1918. From 1920 until 1926 he was with Asia Engineering Corp. of Shanghai as chief engineer and introduced vapor heating in China where it had been previously unknown. The following year he joined the staff of Heating and Ventilating Magazine as technical editor and served as American representative for Industrial Heating and Ventilating Magazine of London, England. In 1928 he joined C. S. Leopold, Philadelphia, Pa., as chief draftsman and specification writer for a year.

Mr. Alt was an instructor in steam engineering at the New York Evening Trade

Harold L. Alt
Baltimore, Md.

Schools and an instructor in air conditioning at the Mechanics Institute and Herkimer Institute.

He was responsible for the mechanical design for such projects as du Pont Engineering Center, Wilmington, Del.; Ford Motor Co., Detroit, Mich.; General Electric Co., Schenectady, N. Y.; Nuclear Research Laboratory, Columbia University; and the Army Institute of Pathology, Washington, D. C.

Mr. Alt is a member of the ASSE, SAME, WCK Alumni Association, and an honorary member of the Eugene Field Society of Authors and Journalists.

EARLE S. BURNETT, Amarillo, Tex.—Senior mechanical engineer, Bureau of Mines, Amarillo Helium Plant. Mr. Burnett was born in River Falls, Wisconsin, in 1880. He studied at Wisconsin State Normal School in River Falls before attending the University of Wisconsin. He graduated from the University in 1905 with a B.S. in mechanical engineering and did post graduate work through 1906, pursuing advanced studies in mathematics and thermodynamics. He remained as research assistant at the University in the Mechanical Engineering Department until 1910 at which time he joined the staff of Cornell University as an instructor in experimental engineering.

In 1914-15 he made independent studies on hydraulic compression of air and from 1917 to 1921 he was with the Bahnson Humidifier Co., Winston-Salem, N. C., first as a research engineer and then as a sales engineer.

Mr. Burnett, who retired from the U. S. Bureau of Mines this past March, joined

Earle S. Burnett
Amarillo, Tex.

the staff of the Bureau in 1923. He is considered an expert mathematician and physicist on helium activities.

Mr. Burnett is also a member of the Society of American Military Engineers and has been a member of Sigma Xi, honorary engineering society, since 1908.

LUTHER D. EMMERT, Chicago, Ill.—Has been associated with Buffalo Forge Co. for the past 37 years and has been a member of the Society since 1919. Mr. Emmert was born in 1885 in Saline, Mich., and was graduated from Cornell University, Ithaca, N. Y., with a degree in civil engineering. He joined the Dravo Construction Co., Pittsburgh, Pa., in 1911 as an engineer, and from 1912-13 was an engineer and designer of coal handling apparatus with the Roberts Shaeffer Co., Chicago, Ill.

JOHN J. WALTERTHUM, New York, N. Y.—Has spent his entire business career in the heating contracting field. Mr. Walterthum was born in 1880 in Jersey City, N. J., and received his education in

J. J. Walterthum
New York, N. Y.

public schools there. From 1898 until 1903 he learned the fundamentals as mechanic and foreman, then established his own contracting business. In 1914 he joined the Arthur Janes Co. as assistant treasurer of the company. In 1922 Mr. Walterthum again went into business for himself as a heating contractor in New York.

ORION O. OAKS, Somerville, N. J.—Mr. Oaks was born in 1884 in Baltimore, Md., and graduated from Stevens Institute of Technology, receiving an M.E. degree. During his high school and college years, Mr. Oaks was employed as a power plant operating engineer for the Commonwealth Water and Light Co. He received his drafting experience with Walker & Chambers, New York, N. Y., where he was employed from 1905-07 and for the next seven years he was engineer and superintendent for M. Chrystal, of Summit, N. J. Mr. Oaks joined the staff of the American Radiator Co., New York, N. Y., as chief of the engineering department and spent 25 years in this assignment.

Mr. Oaks joined the John B. Pierce Foundation in 1944, first as a consulting engineer and then as director of research at its New Jersey laboratory. In 1949, Mr. Oaks organized his own consulting firm, Orion O. Oaks Associates.

Louis A. Welch, Jr.
Schenectady, N. Y.

LOUIS A. WELCH, JR., Schenectady, N. Y.—Retired. Mr. Welch was born in 1880 in Lee County, Rochelle, Ill., and moved to Schenectady in 1892, where he received part of his education. In 1910 Mr. Welch started his career in the heating and plumbing business, organizing his own company, Welch Bros. He retired from the business in January 1950.

Mr. Welch is a Mason, a member of the I.O.O.F., the Schenectady Rotary Club and the National Association of Master Plumbers.

WILLIAM K. SIMPSON, Waterbury, Conn.—Secretary of the Connecticut Board of Registration for Professional Engineers and Land Surveyors. Mr. Simpson was born in New Haven, Conn., in 1884 and attended Sheffield Scientific School, Yale University receiving degrees of Ph.B. in 1905 and M.E. in 1907.

From 1907-08 he was assistant master mechanic at the Chicago refinery of Corn Products Co. and was associated with the Nason Mfg. Co., N. Y., as a mechanical engineer and general superintendent from 1908-19. He joined the staff of Hoffman Specialty Co., Waterbury, Conn., in 1919, first becoming secretary and then vice president and director. Between 1928 and 1942, Mr. Simpson was also proprietor of R. H. Brown & Co., vice president and director of Motors, Inc., and president of the Berkshire Co.

Mr. Simpson is also a member of the ASME, the Connecticut Society of Civil Engineers and the NSPE.

Join the Crowd in January at Philadelphia

YOU WILL be welcome in Philadelphia, January 22-25, 1951, when the Philadelphia Chapter will be host to the Society for its 57th Annual Meeting. The Bellevue-Stratford Hotel at Broad and Walnut Sts. has been selected for the registration headquarters, and the JOURNAL pages should be carefully watched for program announcements and for the location of technical and entertainment functions.

A. J. Nesbitt, general chairman of the Committeee on Arrangements for the Meeting, has announced the complete personnel of the various committees. Merrill F. Blankin, past president of the Society, has been named Honorary Chairman and F. H. Buzzard will serve as Vice Chairman. Plans to insure a successful meeting are in progress and the Philadelphia Chapter members and their wives have elaborate plans for the members and guests who are expected to attend.

The Philadelphia Chapter has acted as host to the Society for three previous Annual Meetings in 1921, 1930 and 1942, and once more promises an interesting program with five technical sessions devoted to timely topics.

COMMITTEE ON ARRANGEMENTS

A. J. Nesbitt, *General Chairman* — **M. F. Blankin,** *Honorary Chairman* — **F. H. Buzzard,** *Vice Chairman*

Banquet—M. E. Barnard, *Chairman;* H. R. James, E. C. Lambert, C. J. Lubking, W. W. Malloy, H. H. Mather, G. W. Powell, Jr., G. E. Tuckerman, F. B. Wilder.

Entertainment—E. K. Wagner, *Chairman;* R. H. Ackermann, R. J. Augusterfer, H. H. Erickson, H. J. Faltenbacher, H. W. Goldner, J. H. Hucker, R. F. Hunger, L. P. Hynes, M. G. Kershaw, Lawrence Macrow, R. S. Mizener, S. R. Nusbaum, F. F. Pfeiffer, A. M. Robertson, Karl Rugart, Edward Semel, R. J. Sigel, J. K. Walters.

Exposition—C. F. Dietz, *Chairman;* C. G. Binder, H. W. Doerrfuss, C. J. Forve, William Garnett, Nicola Ginzburg, A. A. Granke, H. E. Grossman, J. E. Heim, J. J. Hucker, Jr., H. K. King, A. E. Kriebel, H. H. Mohrfeld, A. G. Mutimer, H. M. Parent, R. M. Sharp, G. F. Smith, W. D. Strause, H. N. Teuber.

Finance—A. C. Caldwell, *Chairman;* C. B. Eastman, Edwin Elliot, R. J. Lee, L. E. Moody.

Ladies—E. H. Dafter, *Chairman;* G. F. Bertrand, R. H. Smiles. *Assisted by:*—Mmes. R. S. L. Arnold, M. E. Barnard, G. F. Bertrand, M. F. Blankin, F. H. Buzzard, L. M. Church, W. P. Culbert, E. H. Dafter, C. F. Dietz, John Everetts, Jr., H. B. Hedges, J. H. Hucker, R. F. Hunger, M. G. Kershaw, J. O. Kirkbride, C. S. Leopold, Ludwig Mack, H. H. Mather, J. W. McElgin, L. E. Moody, A. J. Nesbitt, E. K. Wagner.

Publicity—W. P. Culbert, *Chairman;* G. P. Alexander, A. E. D'Ambly, S. E. Plewes, R. D. Touton.

Reception—J. O. Kirkbride, *Chairman,* L. M. Church, *Co-Chairman;* R. S. L. Arnold, T. J. Atkins, Lucien Buck, P. A. Cavanagh, S. E. Farrington, H. E. Gross, H. B. Hedges, A. H. Koch, C. S. Leopold, James Marshall, H. G. McCullough, F. B. Millham, H. B. Prewitt, J. J. Quinn, R. P. Schoenijahn, W. S. Scott, C. D. Shields, Pierce Timmis, L. A. Tucker.

Sessions—John Everetts, Jr., *Chairman;* Alan Dombro, R. E. Sexton, M. A. Sheffler, D. J. Smith.

Transportation—Isadore Director, *Chairman;* E. I. Curley, F. N. Darby, L. C. Davidson, J. E. Hutchison, Ludwig Mack, P. H. Yeomans.

The topics to be discussed at the technical sessions will be selected by the Program and Papers Committee and announced in later issues of the JOURNAL. Plans are already in the making for inspection trips, and special events will be planned to keep the ladies busy while the more technically minded males are at the technical sessions or out at the Commercial Museum.

The 10th International Heating and Ventilating Exposition will be housed in the Commercial Museum at 34th and Pine Sts. The Exposition, also known as the Air Conditioning Exposition, will open officially on Monday afternoon, January 22, at the Commercial Museum, and will continue through Friday, January 26. Announcement has been made by C. F. Roth, manager of the International Exposition Co., with headquarters at 480 Lexington Ave., New York, that the display will be the largest of its kind ever held. Mr. Roth bases his forecast on the advance reservations by former exhibitors, which will require most of the available space.

The Philadelphia Chapter extends a cordial welcome to you to the city of unforgettable hospitality. Among the Philadelphia's firsts will be found: first iron works, first pottery, first glass works, first paper mill, first American-made printing press, first weekly newspaper, first public library, first United States Mint, first stationary steam engine, first hospital for blind, and the first World's Fair.

The City of Philadelphia (the City of Brotherly Love), rich in American history, has much to offer the visitor from out-of-town in the way of modern buildings, educational and historical points of interest, not to forget the famed Liberty Bell, which, as we all know, first proclaimed American Independence, and which, during these days, means so much to each and everyone of us. It still hangs from its original beam, brought here with the Bell from England in 1752 for the purpose of summoning the members of the Colonial Assembly to its meetings. While being taken from the ship it was cracked and recast in Philadelphia in 1755. Following the signing of the Declaration of Independence it was rung on every subsequent Fourth of July until the year 1835, when it was cracked while being tolled for the burial of Chief Justice Marshall.

Adjoining Independence Hall is Congress Hall where the first Congress of the United States was held, and where Washington's second inauguration took place. Not far from here is Carpenter Hall which was the scene of many Colonial events.

Another landmark is Christ Church yard where Benjamin Franklin, the Patron Saint of the Society, is buried along with several of the signers of the Declaration of Independence. Other historic churches which can be seen in Philadelphia are Old Swede's Church, built in 1700, and St. George's Methodist Episcopal Church.

HOTEL RATES

HOTELS	SINGLE	TWO (Double Bed)	TWO (Twin)	SUITES
ADELPHIA, Chestnut at 13th St.	$5.00—6.00	$8.00—10.00	$ 9.00—12.00	$25.00
BARCLAY, Rittenhouse Sq.			$ 8.00—12.00	$20.00—30.00
BELLEVUE-STRATFORD, Broad and Walnut Sts.	$4.50—6.00	$8.00—10.00	$ 9.00—12.00	$20.00—30.00
BENJAMIN FRANKLIN, Chestnut at 9th St.	$5.00—6.50	$7.50— 9.00	$10.00—11.50	$15.00—20.00
BRIERHURST, 45th at Walnut	$3.00	$4.00— 5.00	$ 6.00	
CHANCELLOR HALL, 13th St. below Walnut		$7.00		
CLINTON, 10th St. below Spruce		$7.00	$ 8.00—10.00	
CONGRESS, 1334 Walnut St.		$7.00	$ 9.00	
DRAKE, 1512 Spruce St.		$7.00	$ 9.00	$15.00
EARLE, 111 South 10th St.	$3.00	$5.00	$ 5.00	
ESSEX, 13th at Filbert St.	$4.50	$7.00— 7.50	$ 9.00	
GLADSTONE, 11th and Pine Sts.			$ 6.00	$ 7.00—10.00
HAMILTON COURT, 39th and Chestnut Sts.	$4.50	$7.00	$ 9.00	$12.00
HARRIS, 115 So. 40th St.		$6.00		
JOHN BARTRAM, Broad and Locust Sts.	$4.50—5.50	$7.00— 8.00	$ 8.00— 9.00	$10.00—18.50
LULU TEMPLE, 313 S. Broad		$8.00	$ 9.00	
MARLYN, 40th and Walnut Sts.		$7.00	$ 7.00	$12.00
NORMANDIE, 36th and Chestnut Sts.		$6.00	$ 7.00	$ 8.00
PATRICK HENRY, 208 South 8th St.	$2.50	$4.00	$ 4.50	
PENN SHERATON, 39th and Chestnut	$5.00—6.00	$7.00— 7.50	$ 7.50— 9.00	$12.00—15.00
RITTENHOUSE, 22nd and Walnut	$3.00—3.50	$4.00— 4.50	$ 5.50	$ 6.00— 9.00
RITZ-CARLTON, Broad St. at Walnut	$6.50—7.00		$10.00	$16.00
ROBERT MORRIS, Arch at 17th	$4.00—4.50	$6.00— 8.00	$ 8.00	
ROOSEVELT, 23rd and Walnut			$10.00	$15.00
ST. JAMES, 13th and Walnut Sts.		$5.50— 8.00	$ 6.00— 9.00	$12.00
SYLVANIA, Locust and Juniper Sts.			$ 8.50—10.50	$20.00
WALNUT PARK PLAZA, Walnut at 63rd St.		$8.00	$ 9.00	$14.00
WARBURTON, 20th and Sansom Sts.	$4.00	$7.00— 7.50	$ 7.00— 7.50	
WARWICK, Locust at 17th St.			$ 8.00—11.00	$18.00—22.00
WHITTIER, 15th at Cherry Sts.		$5.50	$ 6.00	

The Betsy Ross House, where the first American flag was made, the Philadelphia Navy Yard, and many other places will hold the attraction of the visitors.

Valley Forge, 15 miles outside of Philadelphia and reached by fine motor roads and by the Reading Railroad, is one of America's patriotic shrines. Here Washington encamped during the winter of 1777-1778 with the Continental troops. Washington's headquarters are preserved and the various points of interest are marked.

Franklin Institute and Museum will have special interest to the engineering profession, with its 4000 exhibits which demonstrate the part science plays in everyday life and industry. Nearby is the Fels Planetarium, the Philadelphia Art Museum, the Rodin Museum, the Academy of Natural Sciences and the Public Library.

Philadelphia is also wealthy in its educational institutions with the University of Pennsylvania, Temple University, Girard College (founded for the education of orphaned boys), and Drexel Institute of Technology.

Philadelphia is amply served by railroads and airlines and from the northern, southern and western points rail service is provided by the Baltimore & Ohio, Lehigh Valley, Pennsylvania, and Reading Railroads. The Municipal Airport is one of the largest and is served by major airlines providing service from all points via American, Capital, Eastern, National, Trans-World, and United Airlines.

Make plans now to be in Philadelphia, January 22-25, 1951, for the Society's 57th Annual Meeting and for the biggest display of equipment ever to be housed in one place. Hotel reservation forms have been mailed to all members and should be sent directly to the Housing Bureau of the ASHVE, Architects' Building, Philadelphia 3, Pa. Acknowledgment of your reservation will come to you directly from the Housing Bureau with a confirmation from the hotel.

*Summary of Chapter Meetings**

• **NEBRASKA**—June 13, 1950. This meeting consisted of an outing and buffet dinner for members, guests and their wives. There was no chapter business but the results of the election were announced as follows: *President*—G. W. Colburn, *Vice President*—K. E. Martin, *Secretary*—S. W. Black, *Treasurer*—O. J. Smith. K. R. Magarrell was master of ceremonies and presented a past president's pin to retiring Pres. C. A. Carter, who, in turn, presented the gavel to the incoming president, Mr. Colburn. The meeting adjourned at 11:30 p.m. Attendance 33.

• **NORTH TEXAS**—May 15, 1950. The meeting was called to order by Pres. Herman Blum, the presiding officer, at 8:00 p.m. in the Melrose Hotel. Members and guests introduced themselves and the minutes of the previous meeting were read and approved.

F. L. Gray, Jr., of Carrier Corp., Dallas, introduced the speaker of the evening, H. E. Rex, who has been with Carrier Corp., Chicago, since 1929. Mr. Rex explained some of the methods used in the application of centrifugal machines to both air conditioning and low temperature work. His talk was well illustrated by the use of slides and was followed by a question and answer period which was enjoyed by all present. The meeting was adjourned at 10:00 p.m. Attendance 66. Attendance ratio 0.32.

• **NORTHEASTERN OKLAHOMA**—June 13, 1950. Members and guests met at Smith's Restaurant at 6:30 p.m. for a dinner meeting. W. R. Lee called the meeting to order and the minutes of the previous meeting were read and approved.

The speaker of the evening was E. B. Cover, branch manager of the York Corp., Tulsa, Okla., who divided his talk into two sections. The first part was on the new ASRE refrigeration code—its application and relation to the proposed local code: while the second part

Nebraska Chapter Officers
***Left to right*—K. E. Martin, vice president; O. J. Smith, treasurer; G. W. Colburn, president; C. A. Carter, retiring president; and S. W. Black, secretary**

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

included a discussion on *Low Temperature Refrigeration*. General discussions were held on each subject. The meeting adjourned at 9:30 p.m. Attendance 19. Attendance ratio 0.61.

• **SOUTHERN CALIFORNIA**—June 21, 1950. Pres. J. L. Blake called the meeting to order at 8:30 p.m., after dinner at the Conde French Restaurant, and the secretary and treasurer made their reports. As there was no new business, the new officers for the coming year, 1950-51, were installed and past president's pins were presented to retiring President Blake and to R. S. Farr, the chapter president for the year 1948-49.

The speaker of the evening was Warren Viessman, manager, Heating and Ventilating Branch, Research and Evaluation Laboratory, U.S. Naval Construction Battalion Center, Port Hueneme, Calif. His subject covered the research project conducted by Abbott-Langley in England, and was illustrated by motion pictures. The meeting adjourned at 10:00 p.m. Attendance 50. Attendance ratio 0.23.

• **SOUTHWEST TEXAS**—July 18, 1950. The meeting was called to order at 9:00 p.m. in the Commodore Perry Hotel by Pres. L. S. Pawkett. President Pawkett then showed an excellent film entitled *By Jupiter* relative to the ability of an individual to make or break a day for himself and others with whom he comes in contact by his own attitude toward selfishness.

W. E. Long, secretary of the Chapter, gave a short talk on the research work being done by the Bureau of Engineering Research of the University of Texas on a ceramic housing project constructed by Acme Brick Co. and The Coates Co. This general information introduced the background for a talk by Dr. F. E. Giesecke on *The Thermal Capacity of Building Materials*. Both talks were informative and provoked an interesting informal discussion period in which the speakers and the audience participated. The meeting adjourned at 11:20 p.m. Attendance 49. Attendance ratio 0.45.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month, 32 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by September 24, 1950, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

BRINKER, L. E., Asst. Mech. Engr., Los Angeles Board of Education, Los Angeles, Calif. REFERENCES: Stuart Giles, L. J. Helms, F. J. Keeler, R. A. Lowe.

CLARK, J. W., JR., Exec. Vice-Pres., Clark Heating Co., Inc., Columbia, S. C. REFERENCES: C. H. Flink, Frank Kise*, W. L. Marshall*, H. W. Reil*.

COGHLAN, J. R., Htg. and Vtg. Engr., Industrial Welfare Div., Dept. of Labour & National Service, Melbourne, Australia. REFERENCES: A. E. Atherton, R. W. Nettle*, A. R. Putam*, E. J. C. Rennie*.

COLBY, H. R., Asst. Prof. of Mech. Engrg., University of Michigan, Ann Arbor, Mich. REFERENCES: F. N. Calhoon, C. F. Kessler, Axel Marin, E. T. Vincent*.

COOLEY, E. C., JR., Field Application Engr., E. C. Cooley Co., San Francisco, Calif. REFERENCES: R. D. Knowles, D. E. McLeod, D. I. Murphy, T. J. White.

CORVINELLI, A. J., Computer-Draftsman, Sullivan A. S. Patorno, New York, N. Y. REFERENCES: H. B. Eells, James Mongitore*, G. E. Olsen, S. A. S. Patorno.

DAULONG, E. J., Sales, Catlett Engineers, Inc., Dallas, Tex. REFERENCES: C. A. Baxter, W. C. Loveless, Oslin Nation, F. A. Swindoll.

DAVIDSON, G. E., Sales Engr., Green Colonial Furnace Co., Des Moines, Ia. REFERENCES: R. E. Dawson, Ronald Frazier*, F. P. Isaac, J. K. Walkup*.

DEWHIRST, K. J., Mgr., Toronto Dist., B. F. Sturtevant Co. of Canada, Ltd., Toronto, Ont., Canada. REFERENCES: G. P. Cooper, J. H. Fox, N. W. Kingsland, H. R. Roth.

DODGE, W. W., Staff Engr., Caterpillar Tractor Co., Peoria, Ill. REFERENCES: J. R. Carroll, Jr., C. F. Larson*, Ross Martin*, W. W. Norton*.

ERVIN, G. E., Owner, Gordon E. Ervin Co., Oklahoma City, Okla. REFERENCES: W. J. Collins, Jr., A. R. Morin, H. S. Shafer, R. E. Swan.

FARRELL, W. K., Owner, Farrell Sales & Service, Upper Darby, Pa. REFER-

*Non-Member

ENCES: D. F. Bennett, E. E. Burritt, Jr., H. T. Makin, Jr., Karl Rugart.

HARRINGTON, J. J., Vice-Pres., Weldmaster Construction Co., Inc., Evansville, Ind. REFERENCES: Dave Browning, Jr.*, W. Feig*, Dennis Stallings*, Ferris Traylor*.

HOYLE, A. R., Chief Htg. Draftsman, A. V. Staniforth, Cons. Engr., Hull, Yorks, England. REFERENCES: K. King*, L. J. Overton*, C. E. Pullum, A. V. Staniforth*.

JACOBSON, H. R., Vice-Pres., A. D. Jacobson Plumbing & Heating Co., Inc., Kansas City, Mo. REFERENCES: J. R. Carroll, Jr., A. D. Jacobson, E. L. Jacobson, Seichi Konzo.

KARPENKO, R. E., Application Engr., Minneapolis-Honeywell Regulator Co., Tulsa, Okla. REFERENCES: Edwin Jones, W. R. Lee, W. C. Roads, J. N. Watt.

KAULFUSS, H. P., Staff Engr., Caterpillar Tractor Co., Peoria, Ill. REFERENCES: L. S. Gilbert, L. W. Hessler, G. E. Merwin, B. E. Priest.

LABROUSSE, J. E., Owner, Southern Heating & Ventilating Service, New Orleans, La. REFERENCES: C. V. Bankston, R. B. Guest, L. R. Maxwell, E. O. Thoman.

LOBERG, O. E., Plbg. and Htg. Contr., Loberg Plumbing & Heating Co., Buffalo, Minn. REFERENCES: E. J. O'Donnell, L. K. Reisberg, W. K. Shine, E. R. Wiiliainen.

MADOW, R. I., Dsgnr., John Paul Jones, Cary and Millar, Cleveland, Ohio. REFERENCES: R. L. Byers, Nicholas Meholich*, Andrew Roman, R. A. Urban.

MALCOLM, R. A., Sales Engr., Johnson Temperature Regulating Co. of Canada, Ltd., Vancouver, B. C., Canada. REFERENCES: H. W. Alyea, P. D. Gayman, M. M. Herrick, J. R. Vernon.

MASSIN, PIERRE, Engr., Nessi Freres & Cie, Montrouge, France. REFERENCES: André Desplanches, Alfred Freyholdt, P. R. Marchal, André Nessi.

MCDONOUGH, G. A., Pres., Home Gas Industries, Inc., Chicago, Ill. REFERENCES: B. A. Johnson, H. P. Mueller, F. J. Nunlist, Jr., Dan Collins*.

NORTON, W. J., Cons. Engr., New York, N. Y. REFERENCES: H. H. Bond, Albert Giannini, Ernst Graber, C. A. Miller.

PALMER, O. C., Pres., Palmer Mfg. Corp., Phoenix, Ariz. REFERENCES: R. S. Ash, George Auslander, Leo Hungerford, W. H. Vogan*.

PIERCE, J. H., Dist. Mgr., Richard Equipment Co., Dayton, Ohio. REFERENCES: H. N. Hermann, H. K. Jennings, T. D. Reiley, E. J. Richard.

PRICE, A. P., Mech. Engr., Commercial Leaseholds, Ltd., Hamilton, Ont., Canada. REFERENCES: J. H. Fox, D. O. Price, E. G. Spall, A. J. Strain.

SIMONSON, E. T., Co-Partner, Hughes-Simonson Engrg. Co., Dayton, Ohio. REFERENCES: I. C. Baker, R. A. Gonzales, E. A. Jones, K. B. Little.

SPANIOL, G. W., JR., Owner, American Sheet Metal Works, Dunbar, W. Va. REFERENCES: N. T. Hess, H. S. Kyle*, Archie McNally, W. W. Neds, Jr.

WALLACE, C. P., Engr., C. Wallace Plumbing Co., Inc., Dallas, Tex. REFERENCES: J. V. Edmondson, J. A. McMurry*, R. A. Mixon, J. W. Rush*.

WELLS, W. P., Pres., Mechanical Engineers, Inc., Charlotte, N. C. REFERENCES: Kirkpatrick Cousart, E. S. DeWitt, W. D. Graham, C. N. Witmer.

WIND, M. J., Application Engr., Warren Webster & Co., Camden, N. J. REFERENCES: A. L. Corbman, J. A. Goff, Serge Gratch*, C. S. Leopold.

*Non-Member

REINSTATEMENTS

BUCKLEY, D. J., Mgr., American Cornice Works, Wichita, Kans. REFERENCES: R. F. Bauer, R. F. Jamison, J. W. Jenner, Charles Yoe.

ADVANCEMENTS

BOGGESS, F. S., Sales Engr., Gage Plumbing & Heating, Salina, Kans. REFERENCES: D. M. Allen, H. L. Daasch, R. G. Jeffers, H. H. Lewis.

KNOWLES, R. D., Partner, Bell, Hughes & Knowles, Fresno, Calif. REFERENCES: P. R. Babcock, D. E. McLeod, N. A. Melnick, D. I. Murphy.

MELNIKOFF, C. G., Asst. Mgr., Engrg. Dept., American Engineering Corp., Shanghai, China. REFERENCES: F. W. Hutchinson, N. S. Loh, T. F. Waung, W. S. B. Wong.

SWANSON, N. W., Vice-Pres., McDonnell & Miller, Inc., Chicago, Ill. REFERENCES: J. W. James, G. H. LaRoi, E. N. McDonnell, J. A. Solon.

TOWNER, C. E., Research Supvr., Crane Co., Chicago, Ill. REFERENCES: G. L. Ballantyne, M. K. Fahnestock, E. J. Lefebvre, M. W. McRae.

OBITUARIES

CURTIS H. BEVINGTON
Chicago, Ill.

Word has been received of the death of Curtis H. Bevington on July 18, 1950, a member of the Society since 1936. Mr. Bevington, who served with the Marine Corps in World War I, died in Hines Veterans' Hospital.

Born in Centralia, Ill., in 1893, Mr. Bevington received his education in public schools there. He joined the American Radiator Co. and was a sales engineer from 1915 until 1929, at which time he became manager of the Chicago office of The Trane Co. In 1933 he became associated with the Jas. P. Marsh Corp.

Mr. Bevington organized his own company in 1937 and acted as manufacturers' representative for such companies as Jas. P. Marsh Corp., Vulcan Radiator Co., McDonnell & Miller, Inc., Bell & Gossett Co. and United States Radiator Corp. At the time of his death, he was owner of the C. H. Bevington Co., Chicago, Ill.

Surviving Mr. Bevington are his widow, Dorothy, a daughter, Betty, and a son, Curtis.

FREDERICK G. WITTENMEIER
Chicago, Ill.

Mr. Wittenmeier, a member of the Society since 1945, died on June 4, 1950. He was born in 1900 on July 4, in Chicago, and attended Lane Technical High School and the Illinois Institute of Technology from which he received a B.S. in mechanical engineering in 1922.

From 1922 until the time of his death, Mr. Wittenmeier was vice president in charge of engineering, Wittenmeier Machinery Co. His duties included engineering, estimating and sales of air conditioning and refrigerating systems.

Mr. Wittenmeier was also a member of the *American Society of Refrigerating Engineers* and the *Practical Refrigerating Engineers Association*.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

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Chapters Conference: B. L. Evans, *Chairman;* J. R. Vernon, *Vice Chairman;* P. R. Achenbach, *Secretary.* Members and alternate members selected by local chapters are respectively:

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BALTIMORE: E. L. Crosby—E. J. Morris
CENTRAL NEW YORK: A. L. Jones—J. H. Carpenter
CENTRAL OHIO: E. A. Norman, Jr.,—H. G. Hays
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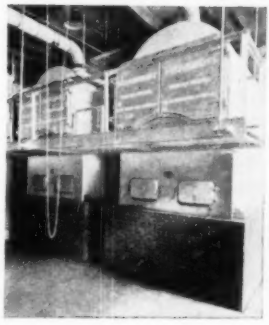

Boiler room of the Bamberger Warehouse. Architects and Engineers: Abbott, Merkt Co. 10 W. 40th St. N. Y. C. Heating Contractor: Frank P. Farrell, Inc. 269 Camden St. Newark, N. J.

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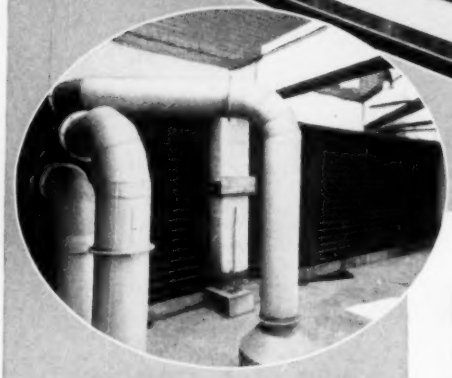
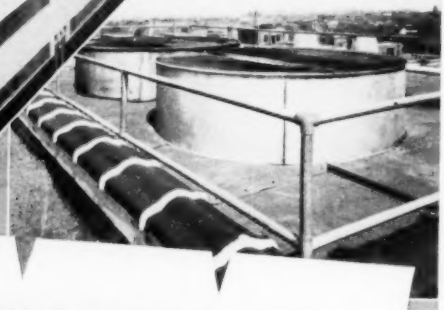
View of top of tower, showing fan guards.



Air inlet louvres shown in photo are heavy 1" x 8" California Redwood.



This C. H. Wheeler water cooling tower serves the air conditioning system installed in the new plant of the Smith, Kline and French Laboratories, Philadelphia, Pa. Responsible for this new building and its air conditioning system were The Ballinger Co., architects; Riggs, Distler & Co., Inc., contractors; and Barclay, White & Co., builders. Carrier Corp. furnished the refrigeration machinery.

HIDDEN COOLING TOWER

Preserves Building Appearance; Still Does Its Job

To look at it you'd never believe there's a water cooling tower serving the air conditioning system for this modern pharmaceutical plant. Even after a second look, you won't find it because it is "camouflaged" into the very top of the building itself. The tower is ruggedly constructed of Construction Heart Grade of California Redwood with an outer casing of brick to match the building's architecture. This cooling tower carries the same guarantees as any other C. H. W. tower, including guaranteed fan horsepower and guaranteed water cooling performance—and yet with a harmonizing casing for appearance as well as safety to meet city fire regulations. When you need a cooling tower for air conditioning or any other application, consult C. H. Wheeler for a custom-built job. Write for descriptive literature.

C. H. WHEELER MANUFACTURING CO.
1826 Sedgley Avenue, Philadelphia 32, Pa.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

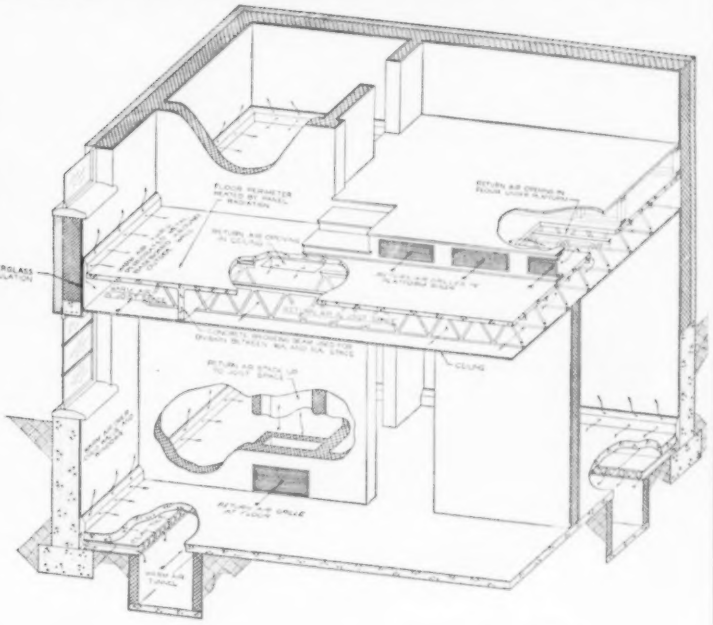
SINCE 1903

C.H. Wheeler

STEAM CONDENSERS • WATER COOLING TOWERS
EJECTORS • STEAM JET VACUUM REFRIGERATION
OF PHILADELPHIA

PERIMETAIR.....

Sensational Distribution Method for Campbell Warm Air Heaters



Combines the Advantages of

FLOOR PANEL RADIANT HEATING
BASEBOARD HEATING and
CONVECTION WARM AIR HEATING

The illustration shows how heated air is brought into a room through a space under the floor. This comfortably warms all or a portion of the floor. The heated air is then distributed in the room through a perforated or slotted baseboard along the entire outside perimeter. This gentle flow of warm air assures complete comfort for anyone sitting next to an outside wall. All the advantages of a well-designed warm air system are all retained in the PerimetAir. The system is low in first cost and economical to operate. There is no water to leak or freeze. Ventilation and humidity are easily controlled. And better, smoother control of temperature is obtained than with any other system.

WRITE FOR FULL DETAILS ON PERIMET AIR

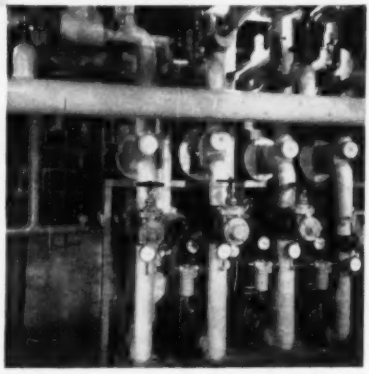
Campbell HEATING COMPANY

3140 Dean Avenue, Des Moines 17, Iowa

For Low Cost Temperature Control—

The long life insulation
PC FOAMGLAS

In the new Georgia Baptist Hospital, Atlanta, Ga., PC Foamglas Pipe and Fitting Insulation has been used on heating and chilled-water pipe lines, finished as shown in accompanying photo. Architects: Stevens & Wilkinson, Inc., Atlanta, Ga. Insulation Contractors: North Brothers, Atlanta, Ga.

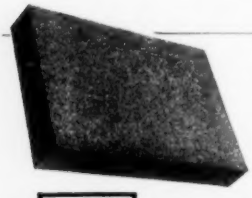


ONLY IN PC Foamglas do you find the unique combination of properties which make it so effective and economical when used as insulation for all sorts of heating, piping and air-conditioning applications.

Foamglas has proved its ability to furnish long lasting aid in maintaining desired temperature and humidity levels when installed in walls and floors, roofs and ceilings of all sorts of insulated structures . . . on indoor and outdoor piping for heating, cooling and processing systems . . . on tanks, ducts, and other air handling equipment.

Foamglas is a cellular glass material which effectively retards heat travel wherever it is used. Its exceptionally high resistance to moisture, vapor and many other destructive elements enables Foamglas to *retain* its original insulating efficiency. Consequent freedom from repairs, maintenance and replacement keeps Foamglas insulating costs at low levels.

The next time you figure on insulation you can get complete, up-to-date information on Foamglas in our current literature. Just send in the convenient coupon and we shall be glad to mail *free* copies of the booklets you select—and a sample of the material.



This is FOAMGLAS®

The entire strong, rigid block is composed of millions of sealed glass bubbles. They form a continuous structure which has unusually high resistance to moisture, vapor and acid atmospheres, is noncombustible, verminproof and odorless. In those closed glass cells, which contain still air, lies the secret of the material's long life insulating efficiency.

Pittsburgh Corning Corporation
Dept. RR-90, 307 Fourth Avenue
Pittsburgh 22, Pa.

Without obligation on my part, please send me your FREE booklets on PC Foamglas Insulation for:

Piping & Equipment ☐ Refrigerated Structures ☐ Commercial & Industrial Buildings ☐ Home Insulation ☐

Name .....

Address .....

City ..... State .....

PITTSBURGH PC CORNING

FOAMGLAS INSULATION

. . . when you insulate with FOAMGLAS . . . the insulation lasts!

HANDSOME IS AND HANDSOME DOES

Gene Boyle's Restaurant, Clifton, N. J. • **Architects:** Shulman & Gurtman, Paterson, N. J. • **Contractor:** R. B. Rider Corp., Passaic, N. J.

...when you specify **kno·draft** adjustable air diffusers

Handsome is . . . the way Kno-Draft *Adjustable* Air Diffusers integrate with *any* decorative theme . . . as soft contrasts in their natural aluminum or, as in the picture above, blended by painting to match the ceiling.

And handsome does . . . a superlatively efficient job of distributing the air to meet *any* desired pattern of flow . . . assuring equalized temperature and volume—*without draft*—throughout the conditioned area.

With Kno-Draft Air Diffusers, both air volume and direction can be adjusted and controlled *after installation*—an important feature. There are models and sizes for every need.

KNO-DRAFT DATA BOOK: Complete specifications, engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. To get your copy, simply fill in and mail the coupon. No obligation, of course.

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Please send me, without obligation, my copy of the Kno-Draft Air Diffuser Data Book.

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Position.....
Company.....
Street.....
City.....**Zone**....**State**.....

Zallea Expansion Joint News

PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

Expansion Joint of the Month

Designed to Meet a Need

UNIVERSAL EXPANSION JOINT

Zallea Stainless Steel Universal Expansion Joints, capable of absorbing combined axial and lateral movements in high temperature lines, have wide application in refineries, chemical, public utility and other industrial plants where it is difficult to anchor the piping and isolate the axial movement of the line from the lateral. The Universal Joint, absorbing movement in all planes simultaneously, reduces the number of anchors required, and also reduces the loads on the supporting steel work, simplifying the erection of today's complex piping. Each Zallea Stainless Steel Universal Expansion Joint is specifically designed to fit the requirements of each individual application. Send us your problem, stating the amount of axial and lateral movement anticipated, the maximum pressure and temperature to be encountered. This involves no obligation, of course. And, ask for Catalog 47—It's free!

ZALLEA BROTHERS
816 Locust Street
Wilmington 99, Delaware

THE Zallea Stainless Steel Universal Expansion Joint was designed to meet the need for a medium capable of absorbing movement in high temperature lines *in any direction*—axially, laterally, angularly, or any combination of these. Illustrated here are the many ways in which this versatile joint may function. In each case, the rectangle shows the original position of the expansion joint.

CASE 1—Axial Movement Only

A Universal Expansion Joint is usually not required unless this axial movement is combined with lateral or angular movement. However, it may be used for axial movement only where the traverse is such as to require more than one joint, and it is not possible to install an anchor between the two joints. In such cases, the tie rods take the place of an intermediate anchor.

CASE 2—Lateral Movement Only

The corrugated element on one end closes on one side and opens on the other, permitting a slight angular deflection. The corrugated element on the other end is similarly deflected in the opposite direction. The longer the section of pipe between the two corrugated elements, the greater the lateral deflection. Notice that the flanges remain parallel indicating that there is no bending in the adjacent pipe. Here the tie rods take the place of pipe anchors.

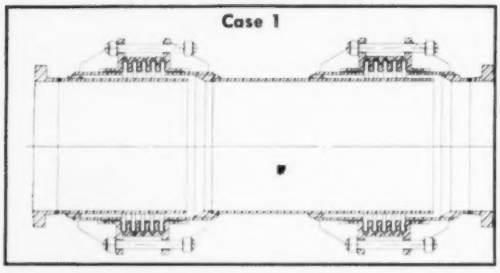
CASE 3—Axial and Lateral Movement

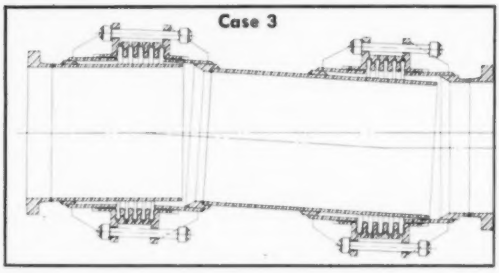
This is a combination of the movements illustrated in Cases 1 and 2, the most frequent application for Zallea Stainless Steel Universal Expansion Joints.

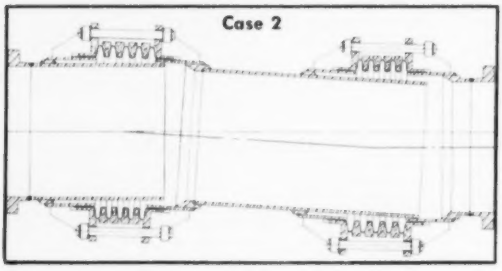
CASE 4—Axial Movement and Angular Rotation

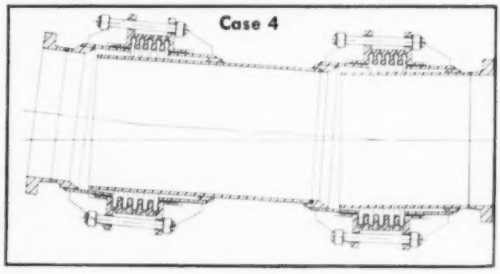
Here axial movement combines with angular rotation. Notice that flanges do not remain parallel, indicating that the pipe attached to the left end of the joint must bend, or that there is another joint at the other end of this pipe to compensate for the angular rotation. Axial and lateral movement may also be combined with angular rotation.

The limit rods shown in all cases are an essential part of the Zallea Stainless Steel Universal Expansion Joint. They are designed so that any two of the four rods will withstand the full line pressure in the event of failure of the anchors on the piping. They also distribute the movement equally between the two corrugated elements.



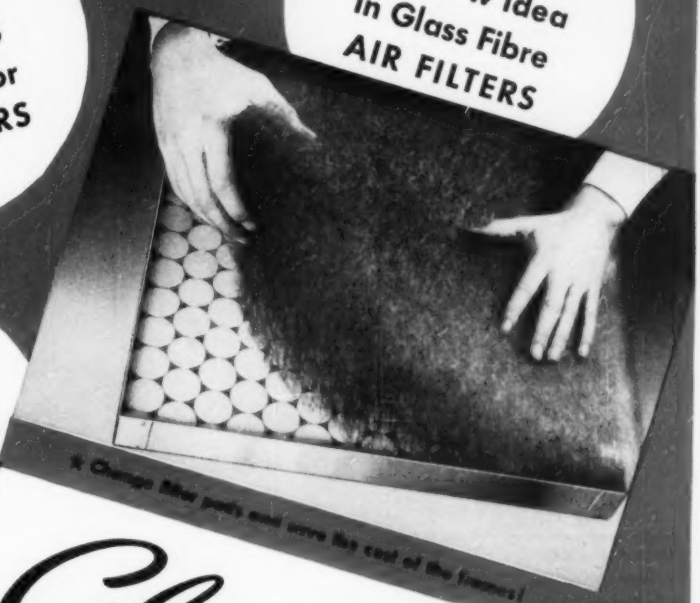






STOP!
Paying 30% too much for AIR FILTERS

LOOK!
At a new idea in Glass Fibre AIR FILTERS



ACT!
Now to save the cost of AIR FILTER FRAMES

* Change filter pads and save the cost of the frames!

Glasfloss
(REFILL TYPE)
AIR FILTERS

Why pay for frames and throw them away! Glasfloss refill type filter pads are furnished in lightweight re-useable frames. When the pad has accepted its full load of dust—throw it away—insert a Glasfloss refill pad and save the 30% that represents the cost of the frame! This is a startlingly new idea you can't afford to miss. Glasfloss refill type filter pads cost less than cleaning old pads for re-use. Glasfloss fibres are so soft and fine that they are safe and comfortable to handle. Soft as a cobweb—Glasfloss fibres form a pad that stops and holds more dust, a fact proved in service under standard industry conditions. For full details write Dept. HP.

DEALERS:
Glasfloss refill type Air Filters offer you a rare opportunity to solicit prize accounts with an economy appeal that's easy to prove. Write for full information.

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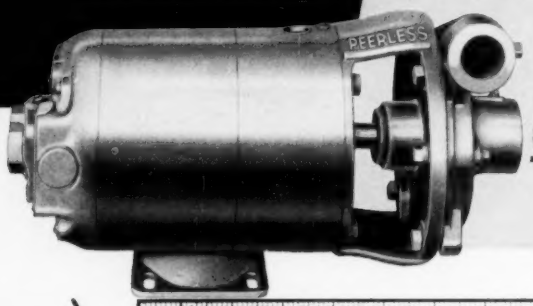
GET ECONOMY, DURABILITY
COMPACTNESS AND

PEAK PERFORMANCE

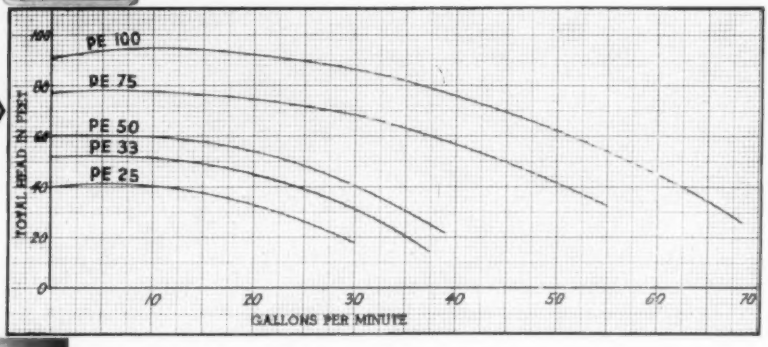
FOR YOUR AIR-CONDITIONING
APPLICATIONS

PEERLESS PUMPS

...WITH FRACTIONAL H. P.
PEERLESS
Fluidyne
TYPE PE PUMPS

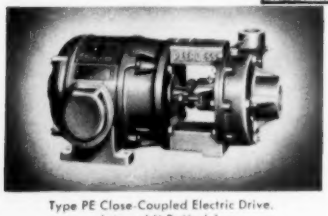


PERFORMANCE CHART SHOWING HEAD-CAPACITY CHARACTERISTICS OF PEERLESS TYPE PE FRACTIONAL H.P. GENERAL PURPOSE PUMPS

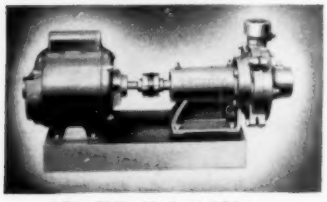


KEY TO PUMP H.P. IN CHART AT RIGHT

PE 25—¼ hp PE 75—¾ hp
PE 33—⅓ hp PE 100—1 hp
PE 50—½ hp PE 150—1½ hp



Type PE Close-Coupled Electric Drive, Integral H.P. Model.



Type PB Flexible-Coupled Drive, Fractional H.P. Model.

ONE OF A COMPLETE LINE OF PEERLESS CLOSE-COUPLED, BELT DRIVEN AND FLEXIBLE-COUPLED PUMPS FOR AIR-CONDITIONING APPLICATIONS

Write for your copies of Peerless Bulletins 2301-2308 inclusive that completely describe and detail the design, operating and performance characteristics of the successful line of Fluidyne Type PE and Type PB pumps. They have a capacity range up to 5500 g.p.m. and a head range up to 270 feet. Larger hp sizes are available up to 40 hp in both electric and belt driven models. Sales and service is available in all principal cities.

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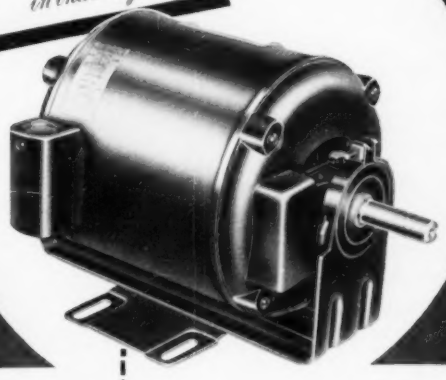
FOOD MACHINERY AND CHEMICAL CORPORATION

Factories: Los Angeles, California, and Indianapolis, Indiana
Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix, Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico

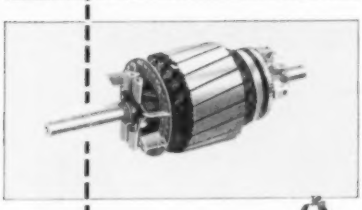
PEERLESS PUMPS fmc

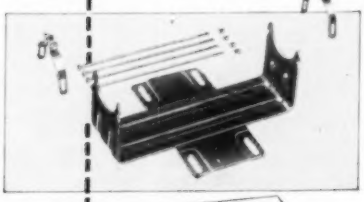
WAGNER MOTORS
...The choice of leaders in industry



Power Your Product With Dependability

Choose a Wagner Motor





Every painstaking step in the construction of Wagner Motors reflects the sound engineering and good workmanship that have made them famous for quality and durability for almost sixty years.

Wagner Motors are available in a wide range of types and sizes for every application. They are compactly built without sacrificing strength or efficiency and are the first choice of many manufacturers because of their dependable performance.

If you need motors that will give long, trouble-free performance and build customer satisfaction—choose Wagner Motors. Bulletin MU-185 gives complete information.

* * *

Buyers of Wagner Motors get Nationwide Service! More than 450 Wagner Authorized Electrical Service Stations and Parts Distributors augmented by 25 Wagner-owned Service Branches are ready to supply on-the-spot service, replacement motors, or genuine Wagner Parts. Write for Bulletin MU-24 for the complete list of names and locations.

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6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

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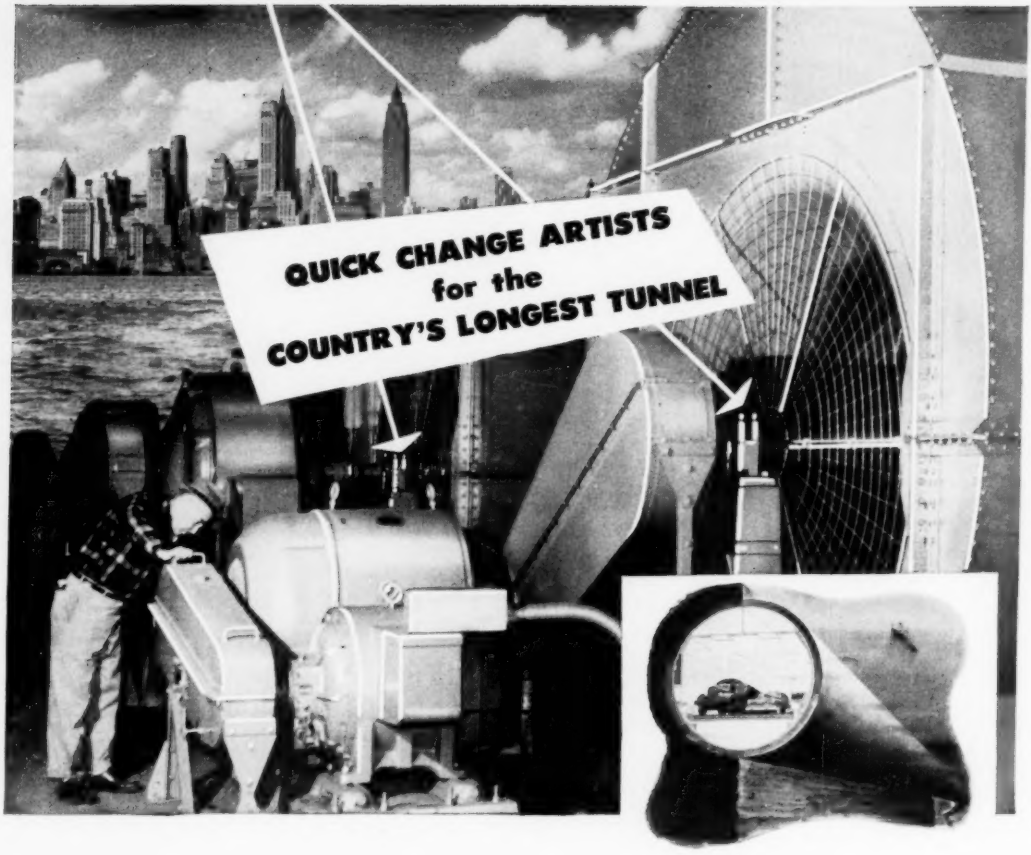
ELECTRIC MOTORS · TRANSFORMERS · INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 29 PRINCIPAL CITIES

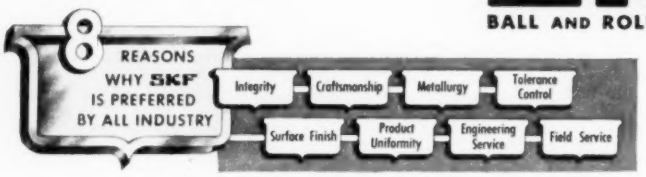
MM-1



Dangerous exhaust gases don't stand a chance in the great new Brooklyn-Battery tunnel. Huge SKF-equipped ventilation fans—53 of them—provide a complete change of air 42 times every hour. Driven by 106 motors that also spin on SKF bearings, these fans—built by Westinghouse Electric Corp., Sturtevant Division—can force 11,100,000 cubic feet of air into the tunnel *every minute.*

SKF Spherical Roller Bearings were the logical choice for this ventilation system because they offer high-standard dependability. They have been specified for most of the major tunnel-fan installations. These bearings, with their inherent rolling self-alignment and extra-long life, give service that's continuous and trouble-free. Once again, SKF has demonstrated the ability to put the right bearing in the right place. **SKF** INDUSTRIES, INC., PHILADELPHIA 32, PA.,
—the Pioneers of the Deep Groove Ball Bearing, Spherical Roller Bearing, Self-Aligning Ball Bearing. 7142

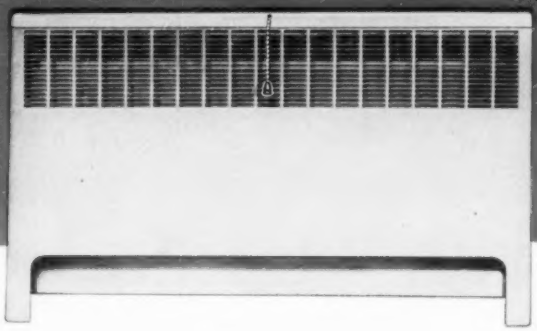
SKF
BALL AND ROLLER BEARINGS



AMERICAN-Standard

First in heating . . . first in plumbing

NOW READY *an improved and more extensive line*



THE NEW MULTIFIN CONVECTORS

in 63 popular stock models . . . in special service models

DESIGNED for installation in all hot water or steam systems, the NEW MULTIFIN line of convectors is now one of the most complete you can handle. Embracing both stock models and special service models, the line includes sizes ranging from a small 18-inch, high, 4-inch deep unit to a large 38-inch high, 10-inch deep unit.

The NEW MULTIFIN Convectors are available in 63 stock model sizes. Factory assembled and packaged for convenient stocking and easy handling, they are shipped ready to connect in either free standing or partially recessed installations.

Special service models offer optional features to meet special building requirements, including extra sizes and types for one-pipe steam and for fully recessed installation. American-Standard Heating Equipment is sold through selected Wholesale Distributors to Heating and Plumbing Contractors. **American Radiator & Standard Sanitary Corporation**, P. O. Box 1226, Pittsburgh 30, Pennsylvania.

LOOK FOR THIS

MARK OF MERIT

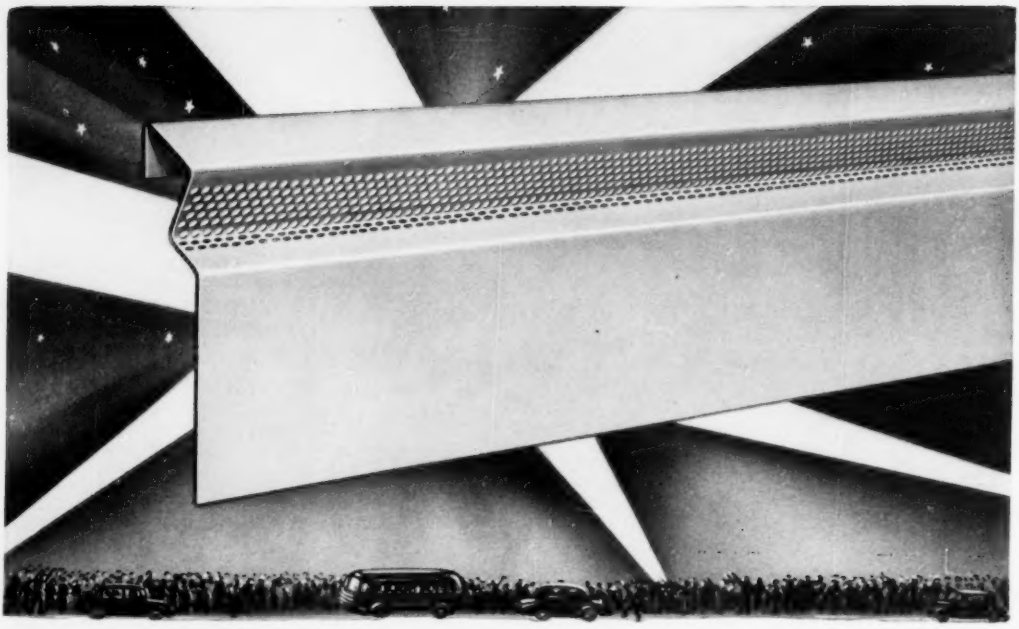
EMPIRE Gas Boiler

for basement or first floor installation

The **EMPIRE** Gas Boiler is one of the most striking gas fired boilers on the market. Its colorful jacket has the new American-Standard Forge Red finish which catches the interest of all who see it on your sales floor . . . and its compact design makes it attractive in basement or first floor installations. The boiler is constructed of durable cast iron and is equipped with precise, dependable controls to assure lowest operating and maintenance cost with maximum comfort. Important among these controls is the automatic gas valve, operated by the thermostat to maintain desired room temperatures effortlessly and economically. To increase the unit's efficiency still further there is a thick layer of insulation under the trim jacket, which prevents excessive heat loss and reduces operating cost.

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON



New Beauty *for Vulcan Baseboard*

MORE EYE APPEAL . . . MORE SALES APPEAL

IN VULCAN'S NEW TYPE L FRONT COVER

Designed Exclusively for Vulcan by famous industrial designers RAYMOND LOEWY ASSOCIATES.

Here is *MAGIC* in Baseboard Cover design. The source of heat becomes invisible because Type L blends so completely with the room decoration — yet the smooth, absolute heating comfort of Vulcan fin-tube radiation is just as effective as ever.

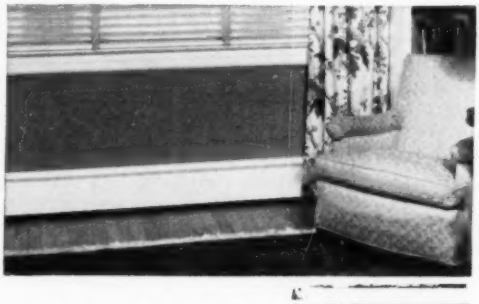
Every architect, heating engineer, and homeowner who was privileged to preview Vulcan Type L gave it instant approval — a sure sign of its sales appeal and popularity.

Made for Semi-recessed and Non-recessed installations, Type L has complete accessories and is available in any desired length in increments of 1".

Remember Vulcan fin-tube radiation is easy to install . . . requires few fittings or supports, comes cut to length, ends threaded or chamfered.

For Smooth Heating Comfort, for Beauty of installation, Vulcan has no equal.

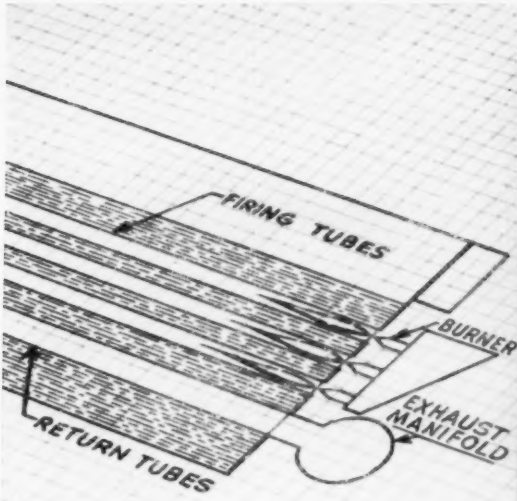
Made in Canada, under trade name of Heal Radiation, by the Vapor Car Heating Co. of Montreal.

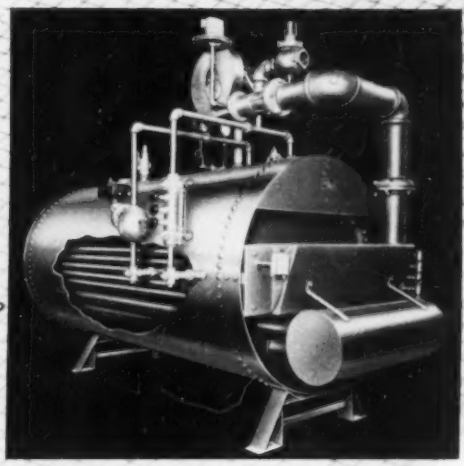


You have to look *twice* to see it . . . experience its smooth heat but *once* to know why Vulcan is specified by leading architects and heating engineers.

Cross section Type L Cover, Semi-recessed. (PATENTED)

THE VULCAN RADIATOR CO.
26 FRANCIS AVE. HARTFORD 6, CONN.





A SELLERS IS SAFE ANYWHERE. THERE IS NO EXPLOSION HAZARD BECAUSE THERE IS NO SEPARATE ENCLOSED COMBUSTION CHAMBER.

The Sellers system of Immersion Firing is engineered for maximum safety under all conditions. Each gas fired tube has its own separate combustion unit and, since they are not enclosed, there is no danger of explosion even if a control should fail.

And with this safety goes maximum efficiency . . . true immersion firing . . . completely submerged firing tubes . . . no heat loss. No wonder the trend is to Sellers Immersion Steam Boilers. Get the facts. Write today for our Bulletin No. 1206-C. It contains full details about the 12 sizes available.

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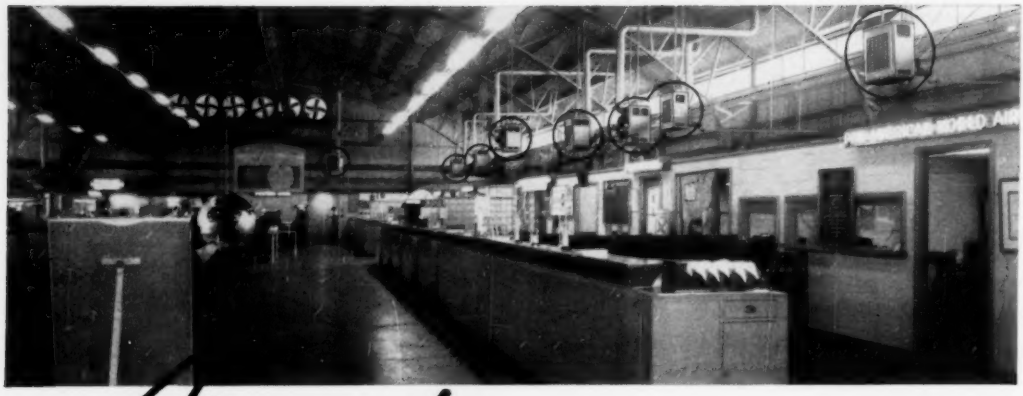
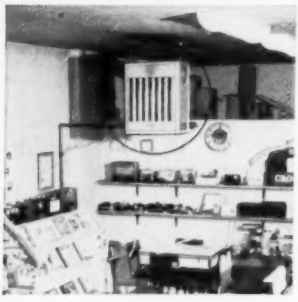
Blast Heaters — Immersion Automatic Water Heaters — Air Heaters — Combustion Units — Industrial Gas Burners Immersion Tank Heaters — Vertical Steam Boilers — Gas Combustion Equipment.



Airport OR APPLIANCE STORE

Janitrol



★

Above: partial view of Moisant International Airport, New Orleans. Air line passengers benefit from both air ventilating and heating. Janitrol Unit Heaters installed by American Heating and Plumbing Company.

★

Small Janitrol Unit Heater provides clean automatic heating for customers' comfort in Cincinnati appliance store. Installation is typical of hundreds made in this city by the A. H. Gerdsen Company.

UNIT HEATERS provide the advantages of clean, automatic gas heat at low installation cost

First question, on heating plans, like everything else these days is usually . . . "*What's the cost?*"

While heating costs include much more than the original installation because of fuel consumption, combustion efficiency, flexibility, maintenance and other factors . . . a *properly engineered* installation of Janitrol Unit Heaters will usually meet all requirements *and cut costs.*

Whether it's a huge building requiring several million BTU/hr. or the corner store with a single Janitrol Unit Heater, installations are made without the expense of installing extensive duct work.

Janitrol Unit Heaters equipped for natural, manufactured or L-P gases, range in capacity from 50,000 to 450,000 B.t.u. per hour input ratings. Suspended and floor models, and types for filtered air comprise the complete line for every commercial and industrial heating requirement.

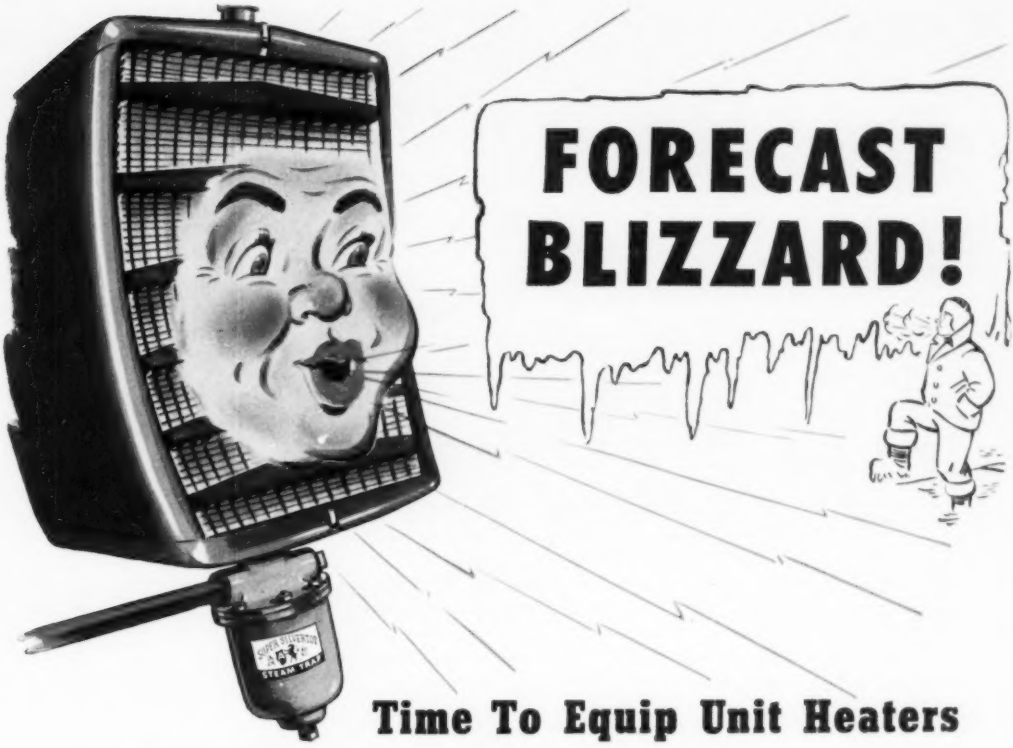
With unit heaters, heat is directed *where* it's needed and *only* when it's needed, an important factor in operating economy.

If building plans call for air conditioning, specially designed Janitrol Gas-Fired Unit Heaters can be quickly installed in the air conditioning duct work. This eliminates duplicating duct work, pipes and blowers, for summer air-conditioning and winter heating use the same distributing system. In hundreds of stores, restaurants, offices, etc. these Janitrol installations conserve valuable space and have proved both practical and economical.

Write today

for your A.I.A. File Folder on Commercial & Industrial Heating. It's a practical guide on the selection and installation of unit heaters to meet a wide range of heating requirements.

SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

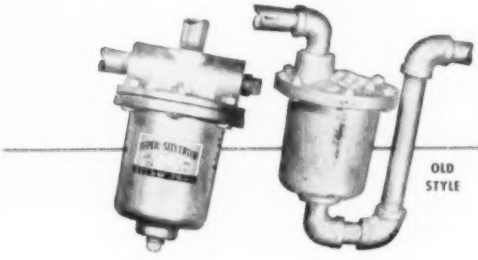


Time To Equip Unit Heaters

with SUPER-SILVERTOP *Steam Traps*

Winter is just around the corner. That means it's time to equip unit heaters with Super-Silvertop steam traps. Super-Silvertops on unit heaters pay for themselves in less than a year by making these units give out more heat at less fuel cost. By keeping water out, Super-Silvertops permit the coils to be completely filled with hot dry air. Super-Silvertops work when other traps fail because they're *activated by water only regardless of temperature.* Presence of water, hot or cold, causes the trap to discharge. Equip unit heaters with Super-Silvertops and watch them pour out heat. They'll reach maximum efficiency in a much faster time. For an economical, warm winter, order Anderson Super-Silvertops installed on every unit heater today. See your nearest representative or write us direct.

THE V. D. ANDERSON COMPANY
1949 West 96th Street • Cleveland 2, Ohio
In Canada: Bawden Machine Co., Toronto



***Only* SUPER-SILVERTOP**
HAS A
GUIDED BUCKET

Why contend with BLOW

The Main Source of Air Conditioning Complaints?

THESE EXCLUSIVE MULTI-VENT ADVANTAGES RESULT FROM THE ABSENCE OF BLOW:

- Complete absence of draft velocities.
- Unparalleled uniformity and control of air temperature and air motion.
- Elimination of all air direction adjustments by diffusing vanes or baffles.

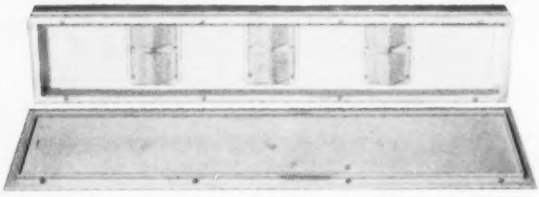
Specify MULTI-VENT (T. M. REG.) CEILING PANELS

Through perforated ceiling areas, Multi-Vent provides perfect overall air distribution entirely by pressure displacement—completely free from BLOW or high velocity injection. BLOW is the direct source of all draft hazards and is responsible for the most serious installation, balancing, maintenance and adjustment problems.

- No restrictions on the location of diffuser, regardless of walls and columns.
- Partitions may be moved at will, even to bisect a panel.
- More room air changes per hour, when required, with less air motion.
- Elimination of dirt impingement on ceiling and wall surfaces.
- Higher Diffusion Temperature Differentials with lower ceilings.
- No change in air diffusion pattern or cold drop when volume of air delivered is varied.
- Complete absence of the sound of rushing air.
- Complete concealment behind standard perforated acoustical ceiling pans.

New THE MODULAR ONE-FOOT MULTI-VENT PANELS . . .

Available in 2, 3, 4, 5, and 6-foot lengths, supplementing the line of two-foot and three-foot wide panels.



MULTI-VENT PANEL WITH PERFORATED DISTRIBUTION PLATE LOWERED
(Standard metal acoustical pans may be substituted for the distribution plate)

For comparatively small air volume requirements in new modular construction.

For long narrow peripheral zoning.

For economical installation in standard suspended ceilings.

For beautiful ceiling design with parallel strips of one-foot flush troffer lighting.

Write for detailed literature and the name of the Multi-Vent sales engineer in your vicinity.

● *MULTI-VENT DIVISION*
THE PYLE-NATIONAL COMPANY
1373 N. KOSTNER AVE., CHICAGO 51, ILL.

Your Next Big
BUSINESS STIMULATOR

The era of *clean air* has arrived. More and more, business and industry are becoming aware of the tremendous advantages of clean, dust-free air. The day is not far off when any heating, ventilating or air conditioning installation without provision for *electrostatic air cleaning* will be considered incomplete.

Are you planning now to get your share of this new and profitable business? Are you aware of the many compelling reasons why owners and operators of stores, shops, banks, hotels, restaurants, theatres, night clubs, mills, factories, offices, hospitals and public buildings are beginning to regard electrostatic air cleaning as a *must*.

Have you all the latest information you need to *sell* and *install* electronic air cleaning in both industrial and commercial fields? The Raytheon sales and engineering staffs are at your service. Write for complete information today.

RAYTHEON

Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY

Waltham 54, Massachusetts

TO HELP YOU SELL CLEAN AIR

Raytheon Manufacturing Company
Dept. 6460-HP, Waltham 54, Massachusetts

Please send complete sales and technical data on Raytheon Precipitators (Electrostatic Air Cleaners).

Name.....Title.....

Organization.....

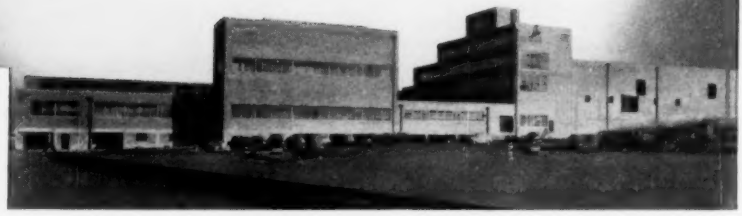
Address.....

City.....Zone....State.....

Other Raytheon products include: Marine Radar; Echo Depth Sounders; Radio and Television Receivers, Tubes and Broadcasting Equipment; Mobile Radiophones; Voltage Stabilizers; Transformers; Battery Chargers and Eliminators; and Other Electronic Equipment

Announcing

MUNDET CUSTOM-MOLDED 85% MAGNESIA HEAT INSULATION



Mundet district offices are located in these cities:

ATLANTA
339-41 Elizabeth Street, N.E.
BOSTON
57 Regent St., North Cambridge 40
CHARLOTTE, N. C.
507 S. Cedar St.
CHICAGO 16
2601 Cottage Grove Avenue
CINCINNATI 2
427 West 4th Street
DALLAS 1
601 Second Ave.
DETROIT 21
14401 Prairie Street
HOUSTON 1
Commerce and Palmer Streets
INDIANAPOLIS
15 E. Washington St.
JACKSONVILLE 6, FLA.
800 E. Bay St.
KANSAS CITY 7, MO.
1428 St. Louis Avenue
LOS ANGELES
(Maywood)
6116 Walker Avenue
NEW ORLEANS 16
315-25 N. Front Street
PHILADELPHIA 39
856 N. 48th Street
ST. LOUIS 9
3176 Brannon Ave.
SAN FRANCISCO 7
440 Brannan Street
In Canada:
Mundet Cork & Insulation, Ltd.
33 Booth Avenue, Toronto

This new Mundet plant is designed to provide you with superior heat insulation. Its facilities for the manufacture of Custom Molded 85% Magnesia Pipe Covering and Block Insulation are unequalled anywhere in the United States.

Operations are automatic and precision-controlled throughout manufacturing. Specially designed equipment and improved methods contribute to the production of heat insulation that serves more effectively, and at lower life-cost.

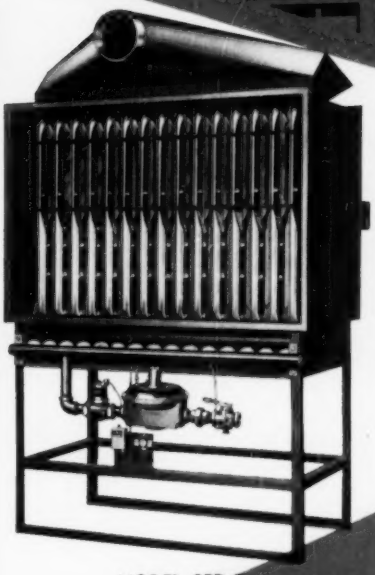
By using Mundet Custom Molded 85% Magnesia Insulation, you benefit from:

- *Greater Heat Saving Efficiency*
- *Controlled Uniformity*
- *Longer Life*
- *Custom Molded Precision Pipe Fit*
- *Attractive, Smooth Finish*

Descriptive folder, with simplified thickness standards, sent promptly on request. Write for it now. Mundet Cork Corporation, Insulation Division, 7207 Tonnelle Ave., North Bergen, N. J.

MUNDET

INSULATION FOR HIGH AND LOW TEMPERATURE



MODEL SFD-[illegible]

HAYES DUCT FURNACE SETS A NEW HIGH STANDARD FOR QUALITY . . .

1. Designed to be used as a direct fired heat exchanger for Industrial-Commercial and Air-Conditioning systems.
2. Requires less floor space than any other direct fired unit of comperable capacity.
3. Stabilized stainless steel heat exchanger and all-welded construction insure long life.
4. Manufactured in 14 sizes to accommodate accurate BTU requirements.
5. Light weight compact design, saves space, labor, and shipping costs.
6. No need to protect heat exchanger with dampers when installed down stream of cooling coils, nor when condensation is probable.

For complete information and specifications write your nearest dealer or

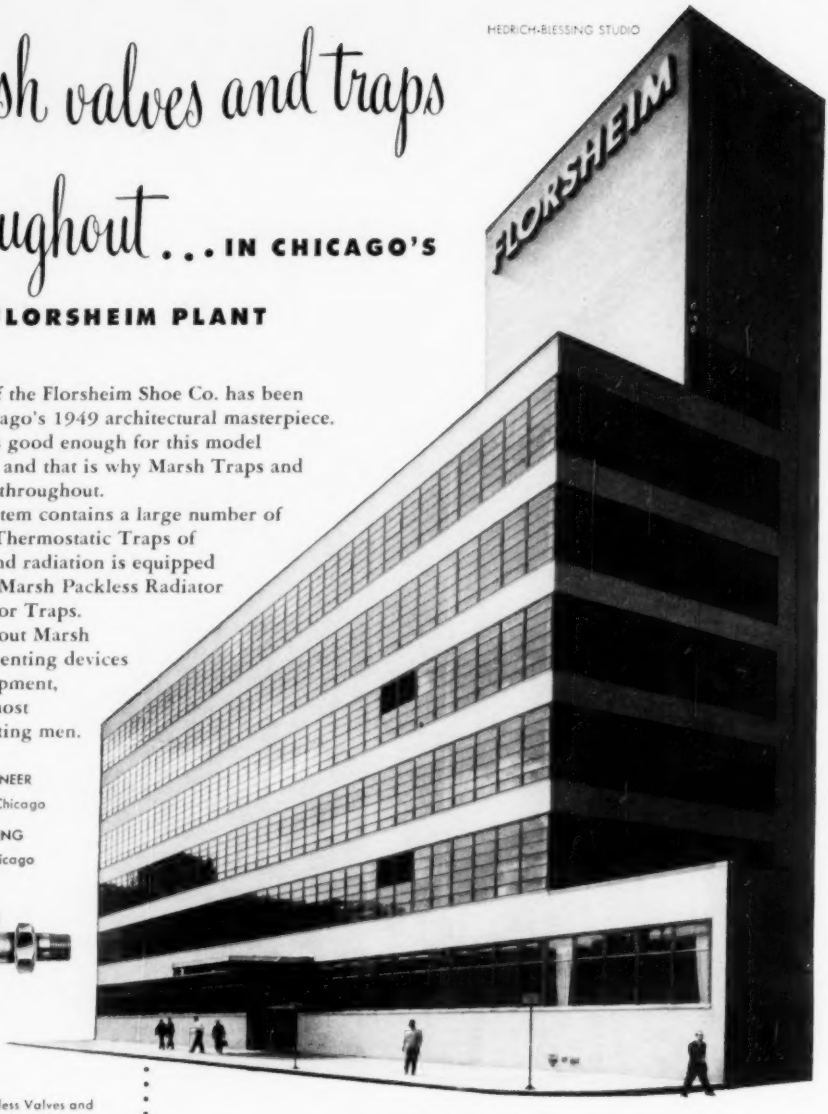
HAYES FURNACE MFG. & SUPPLY CO.
2929 South Fairfax Ave., Los Angeles 16, Calif.

HAYES DUCT FURNACE

BOYD ENGINEERING CO., 123 W. Gromia, Albuquerque, New Mexico • RUMBOLD & CO., 879 Nelson Street, Atlanta, Georgia • BODGERS-BARBOUR CO., Inc., 2021 Cedar Springs, Dallas, Texas. • HARRY HERMAN, 1228 California Street, Denver, Colorado • BOYD ENGINEERING CO., 715 No. Stanton St., El Paso, Texas • LUEDECKE ENGINEERING CO., 3181 North Blvd., Austin 5, Texas • SMITH STEAM SPECIALTY CO., 1116 Temple Bldg., Kansas City, Missouri • J. C. LEWIS, Pyramid Building, Little Rock, Arkansas • J. M. O'CONNOR CO., Oklahoma City, Oklahoma • J. M. O'CONNOR CO., 205 N. Waco Ave., Wichita, Kan. • J. M. O'CONNOR CO., Tulsa, Okla. • E. T. BOMAR, 422 N. First St., Phoenix, Ariz. • TAY HOLBROOK, INC., San Francisco, Oakland, Berkeley, Sacramento, Fresno, San Jose, Stockton, Santa Rosa • STANDARD SCALE & MANUFACTURING CO., Shreveport, La., and New Orleans, La.

Marsh valves and traps throughout . . . IN CHICAGO'S MODERN FLORSHEIM PLANT

HEDRICH-BLESSING STUDIO



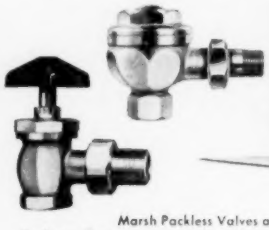
This new plant of the Florsheim Shoe Co. has been described as Chicago's 1949 architectural masterpiece. Only the best was good enough for this model establishment . . . and that is why Marsh Traps and Valves were used throughout.

The heating system contains a large number of Marsh Float and Thermostatic Traps of indicated types, and radiation is equipped with hundreds of Marsh Packless Radiator Valves and Radiator Traps.

Ask for facts about Marsh valves, traps and venting devices —time tested equipment, preferred by the most discriminative heating men.

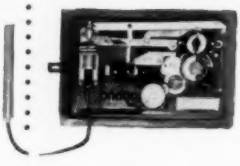
ARCHITECT & ENGINEER
Shaw, Metz & Dolio, Chicago

PLUMBING & HEATING
M. J. Corboy Co., Chicago



Marsh Packless Valves and Radiator Traps are used throughout in the Florsheim plant.

Marsh No. 12 Float and Thermostatic Trap — typical of many float and thermostatic traps, used in the Florsheim plant, which include Marsh No. 8 and No. 14 Traps.



MARSH Tri-Trol . . . heat control in step with the weather . . . EFFECTS BIG SAVINGS

More and more owners of multiple occupancy buildings —from two apartments up to skyscrapers— are finding Marsh Tri-trol the answer to providing maximum comfort at minimum fuel cost. Tri-trol is a simple, low cost, easily installed regulator that pays its way many times over in savings. Ask for details.

MARSH HEATING EQUIPMENT COMPANY
Sales affiliate of Jas. P. Marsh Corporation, Dept. T, Skokie, Ill.

MARSH

Heating Specialties SINCE 1865

Humphrey GAS UNIT HEATERS

Dependable... Economical... Efficient

The demand for gas fired unit heaters is increasing steadily because of their many *plus* advantages . . . advantages that include saving of floor space, economical installation and operation, cleanliness, elimination of boilers and fuel storage. Humphrey Gas Unit Heaters are the finest that over 50 years experience in building gas heating equipment can produce . . . when you sell a Humphrey, you sell complete customer satisfaction.

Available in sizes from 65,000 to 200,000 BTU input ratings; Rotor Type available with louvers or duct adapter.

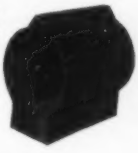
ONLY Humphrey HAS ALL THESE ..... QUALITY FEATURES

SUPER COMBUSTION CHAMBER — Completely new, all steel with special stainless steel lifetime "dual flame" burner tips.

POSITIVE SAFETY CONTROLS — Basoid Safety Pilot shuts off gas in event of pilot outage. Humphrey overload assembly eliminates danger of overheating due to any cause.

ADJUSTABLE LOUVERS — Horizontal or vertical louvers available . . . easy control of angle at which heat is directed downward at desired level.

FREE FLOW HEAT EXCHANGER — Heavy gauge steel, welded for strength and gas-tight construction. Large area, streamlined surface, effects rapid transfer of heat. No baffles to impede flow. Requires no cleaning.



Radiantfires

Circulators

GENERAL GAS LIGHT COMPANY

KALAMAZOO, MICHIGAN

Wall Heaters

Unit Heaters

IN THOUSANDS OF PLANTS...
HOFFMAN TRAPS
ARE STOPPING STEAM WASTE
50 SERIES FLOAT and FLOAT & THERMOSTATIC TRAPS
This heavy duty trap does a precision job under toughest service. All working parts are mounted on the cover — easily removed for cleaning without breaking pipe connections. Pressure range to 125 lbs. Capacities up to 12000 lbs. condensate per hour.
HOFFMAN RADIATOR TRAPS
Removable thermal units and seats are a distinguishing feature of Hoffman Traps, greatly simplifying cleaning and inspection work. Pressure range 0 to 125 lbs. Capacities up to 1250 lbs. condensate per hour.
600 SERIES INVERTED BUCKET TRAP
Straight-through pipe connections, all working parts connected to bonnet and easily removed with it. Interchangeable valve seats for various pressures. Pressure range 0 to 200 lbs. Capacities up to 5000 lbs. condensate per hour.
IN
OUT
HOFFMAN SPECIALTY COMPANY

Right now your customers are ready to take measures that will insure "more heat from less fuel" next winter. Fortunately, a simple modernizing job will accomplish results, in most instances.

First, checking carefully all heating equipment and replacing those units which are not functioning effectively. Second, installing additional valves, traps or pumps where good steam-plant engineering indicates their need. Extra efficiency for the owner, extra profit for you. And once Hoffman Traps are installed, it's a simple matter to make periodic inspection —all working parts are mounted on the covers, easily removed.

Now is the time for you to round up and complete these steam system modernizing jobs. For further particulars on Hoffman Heating System Specialties, ask your wholesaler, or write to

HOFFMAN Steam TRAPS

HOFFMAN SPECIALTY COMPANY, Dept. FG-9
Famous for HOFFMAN VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER

1001 York St., Indianapolis 7, Ind.
HEATING SYSTEMS Sold by leading Wholesalers of Heating and Plumbing Equipment

ALLSTATE
"Great Growth Through Great Service"

The New **ALLSTATE INSURANCE COMPANY** *Building*
Home Office - Chicago, Illinois

ARCHITECT — Carr and Wright, Inc., Chicago, Illinois

CONSULTING ENGINEER — Robert E. Hattis, Chicago, Illinois

HEATING CONTRACTOR — Gallaher and Speck, Inc., Chicago, Illinois

VENTILATING CONTRACTOR — Acord Ventilating Co., Chicago, Illinois

uni-flo MA Grilles in typical interior. Grill frames finished to match wall, cores electroplated.

IN THIS COMPLETELY AIR-CONDITIONED BUILDING . . .

BARBER-COLMAN

Return air grilles in corridor doors — uni-flo Sight-tite.

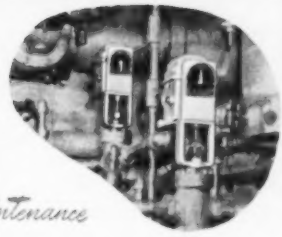
ONE SOURCE FOR BOTH . . .

TEMPERATURE CONTROLS

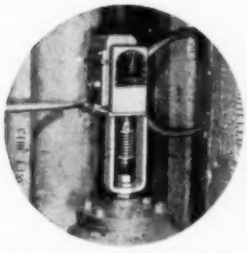
Maximum Performance, Minimum Maintenance

AND uni-flo AIR DISTRIBUTION PRODUCTS

Tops in Appearance as well as Performance



Electric Motor-Operated steam valves.



Electric Motor-Operated Valve in chilled water line.

One of two fan unit control panels.

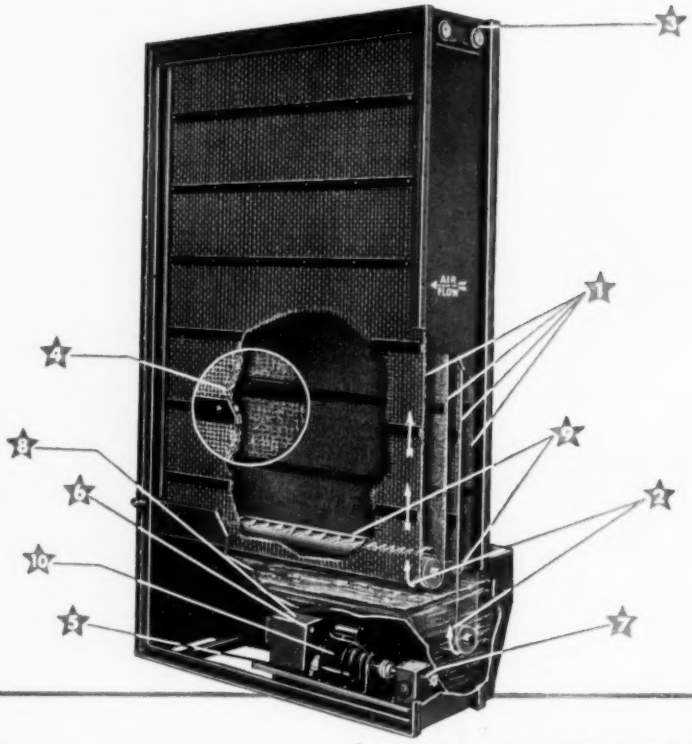
In the planning and construction of this building, the architect, engineer, and contractors were able to work with ONE source — Barber-Colman Company — for ALL of the automatic controls AND all of the sidewall and ceiling outlets in the entire building. Keep this name in mind for *your* next project . . .

BARBER-COLMAN COMPANY
1228 ROCK ST., ROCKFORD, ILLINOIS

STAYNEW AUTOMATIC

No other Air Filter can give you these

10 IMPORTANT FEATURES



1. Double Filter Curtains.
2. Direction of Curtain Travel such that *cleaned* panels are *always* on downstream or filtered air side.
3. Gear and Roller Chain Drive. *No belts to slip.*
4. Highest Efficiency of any mechanical type self-cleaning filter plus exceptionally large dust-handling ability.
5. Motor and Control Unit mounted on *clean* air side of filter.
6. Momentary Contact Time Switch for testing and checking curtain travel and compressed air control.
7. Shear Pin Protection of moving parts from accidental damage.
8. Control Mechanism arranged as an integral part of filter unit or for remote mounting.
9. Compressed air curtain cleaners available for special conditions.
10. Nation-wide Service on both motor and controls.

DOLLINGER CORPORATION

9 CENTRE PARK DOLLINGER PROTECTOMOTOR STAYNEW FILTERS ROCHESTER 3, N. Y.

Get these 5 important advantages with the C-E Premier Boiler

1. **Simplicity** – The C-E Premier Boiler is a simple, down to earth unit... simple to operate, simple to maintain. A minimum of controls – no complicated gadgets. You can depend on the C-E Premier for reliable day in and day out performance with minimum attention.

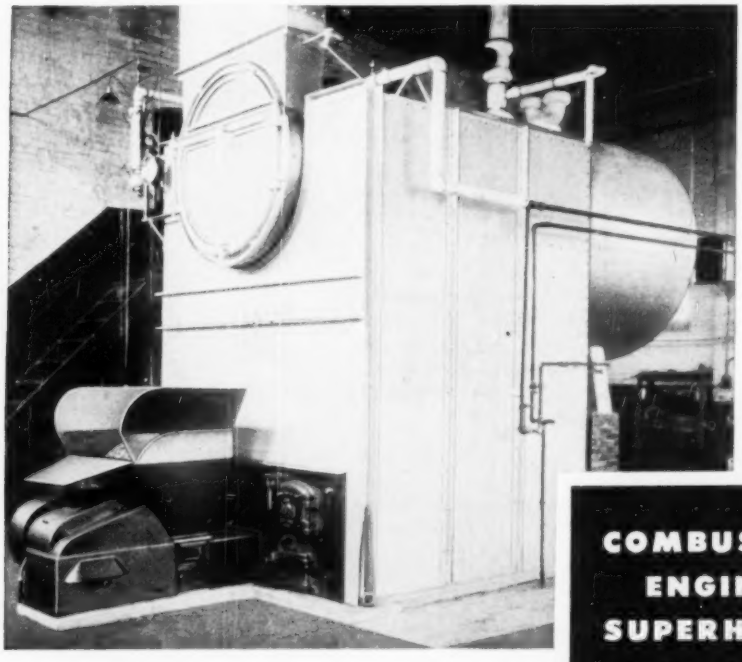
2. **Fuel Versatility** – You'll want the one best method of firing for your particular fuel conditions. The C-E Premier Boiler is designed for stoker firing of either anthracite or bituminous coal or for oil or gas. Moreover, should a change in your local fuel conditions occur, the Premier can be readily converted from one type of firing to another.

3. **Low Maintenance** – The C-E Premier Boiler is a sturdily built, compact unit with all seams fusion welded. No cross braces inside the vessel to get out of repair. All parts of the boiler are readily accessible for cleaning and maintenance. Tubes are accessible at both ends through large flue doors in the rear combustion chamber and in the smokebox.

4. **Low First Cost** – The C-E Premier Boiler is a completely standardized unit designed for stock production. The savings in engineering and erection incident to standardization are passed along to you in the form of lower first cost.

5. **Background** – Combustion Engineering-Superheater has had over sixty years' experience in building boilers of all types, including some of the largest central station installations in this country. This wide experience is reflected in the design and workmanship of every Combustion boiler. It will pay you to investigate C-E before you buy.

B-401



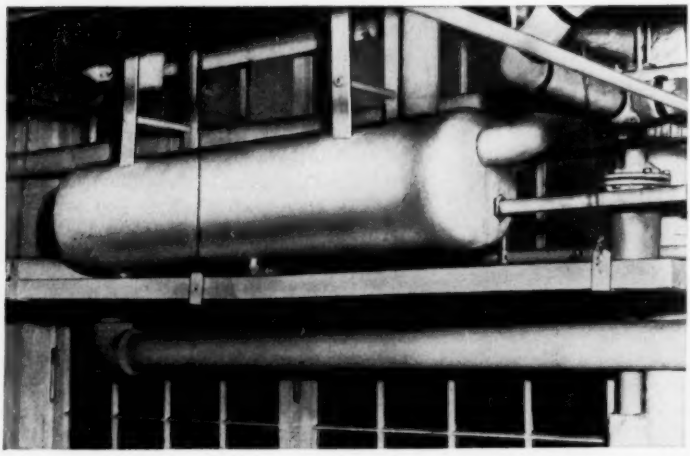
The Premier Boiler is available in seven sizes ranging from 75 to 375 rated horsepower. The unit shown, installed in the plant of a machinery manufacturer, is rated at 120 hp. It is fired by a C-E Skelly Stoker.

COMBUSTION ENGINEERING – SUPERHEATER, INC.

200 Madison Avenue · New York 16, N.Y.

ALL TYPES OF STEAM GENERATING FUEL BURNING AND RELATED EQUIPMENT

Water Heater 12 Feet Overhead Supplies 3 Plant Departments



Measuring only a foot in diameter by 4½ feet in length, this single compact No. 625 General Instantaneous Water Heater supplies the quantities of hot water needed in three departments at the Universal Winding Company . . . one of the world's largest textile machinery plants. It operates at 15 lbs. steam pressure . . . well within capacity.

WASHROOM

RESTAURANT

HOSPITAL

Requires no floor space...no tank... no complicated piping...no long piping runs

The advantages of General Fittings Instantaneous Water Heaters have prompted many companies to add much-needed, extra sources of continuous hot water. These compact, efficient units may be "spotted" almost any place in a plant. Installation is simple and fast. 24 sizes provide a broad range of capacities — up to 300 gallons of hot water a minute. Units are heated with live steam, up to 125 lbs., through the shell . . . or with exhaust steam or boiler water.

If you need an extra source of hot water but are faced with problems such as: space limitations, overall expense, and plant disturbance caused by new construction, look for your ideal answers in a *GENERAL* Instantaneous Water Heater. Send for Catalog 19. General Fittings Co., Dept. A., 123 Georgia Ave., Providence 5, Rhode Island.

GF Instantaneous Water Heater . . . features Bronze Heads—Seamless Copper Tubing.

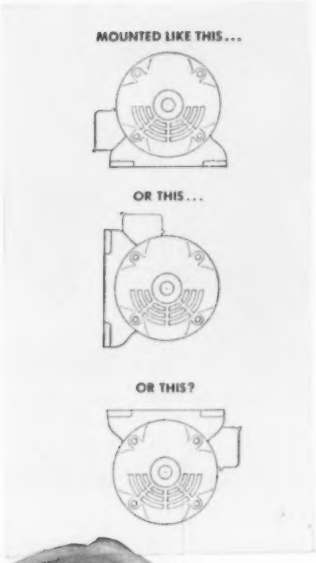
GENERAL

TANKLESS AND INDIRECT WATER HEATERS AND HEATING SPECIALTIES

YOU CAN BE **SURE**.. IF IT'S
Westinghouse

FOR AIR HANDLING

Is your motor *really* dripproof?



. . . AT ANY ANGLE OF MOUNTING—
Do you see a ventilating opening in the frame? Then the motor is probably not dripproof when side wall or ceiling mounted. You need a special motor for these mounting positions . . . with special protection over frame openings. But . . .

You can save the costs of specials with Life-Line motors. Solid frame construction eliminates frame openings. All ventilation is accomplished through the end brackets. Simply rotate the 4-position brackets and the Life-Line is dripproof—for side wall or ceiling mounting.

Dripproof conduit box can be rotated also. Plenty of knockouts give maximum possible connections. And, because a Life-Line motor needs no further lubrication, you can crowd it into cramped quarters . . . mount it in "hard-to-get-at" locations—and forget it. Thus, you get maximum mounting flexibility for difficult mounting problems.

It costs no more to get these "special" features in a standard motor. Simply specify Life-Line as the drive for your equipment. Ask your local Westinghouse representative for details and a copy of booklet B-3842, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21583

If you figure LIFE-COSTS . . . you'll figure LIFE-LINE

Westinghouse
Life-Line
Motors
INDUSTRY'S LEADING MOTOR

A Fine Pump Made Even Better.....

The New Chicago
CLOSE COUPLED PUMP

Completely redesigned, this sturdy, compact unit is now better than ever. 40 years' experience with pumps for every application is built into the newly designed Chicago Close Coupled Pump. A precision mechanical seal insures against leaking. No expensive piping needed from drip pocket to drain. No messy floors. No wasting of glycol type heat transfer agents. The Chicago Close Coupled Pump does the biggest job in the least space.

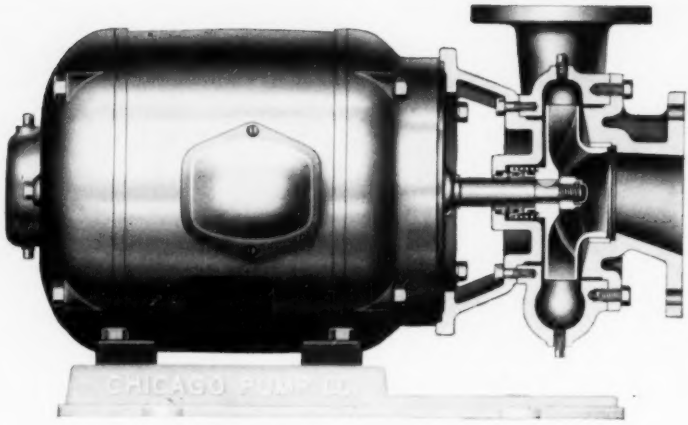


Fig. XN89. Cross section of Chicago Close Coupled Pump.

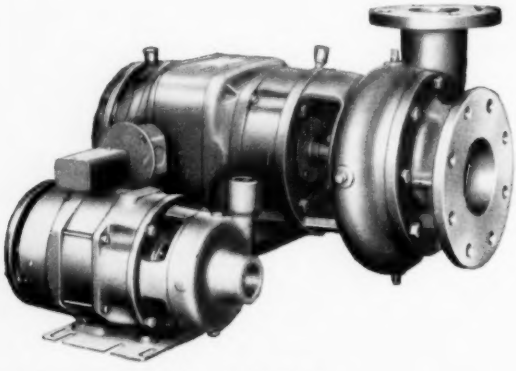


Fig. N8911-8. Two of the new line of Close Coupled Pumps, the 1" NM103 and the 3" NM3.

MECHANICAL DESCRIPTION

Bronze impeller is keyed to a stainless steel motor shaft and is secured with a special lock nut. A precision built mechanical seal on the shaft requires no adjustment and eliminates dripping. Discharge opening may face in any direction. Pipe discharge sizes: 1, 1¼, 2, and 3". For capacities up to 500 G.P.M. and heads up to 215'. Pump may be mounted either vertically or horizontally. Pumps up to 2" have screwed pipe connections. 3" pump has flanged pipe connections.

For complete description and capacity tables, write for Bulletin 108.

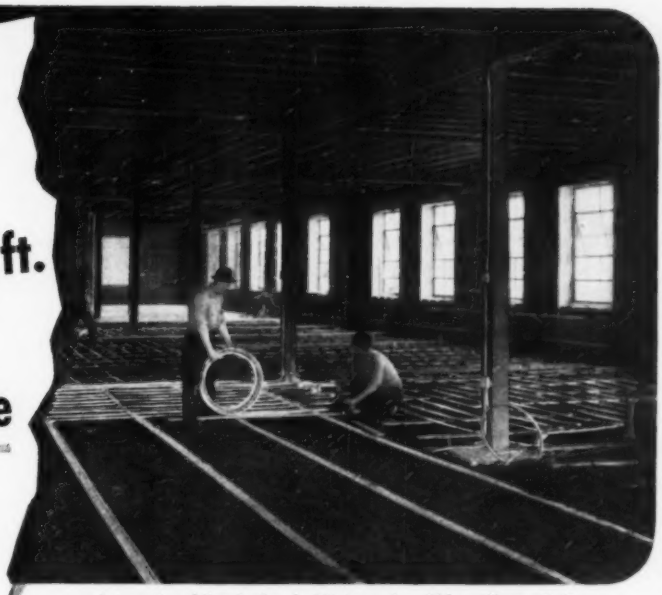
CHICAGO PUMP COMPANY
BUILDING and INDUSTRIAL DIVISION

2300 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps
Pneumatic & Tankless Water Systems

Flush-Kleen Sewage Ejectors
Little Giant & Non-Clog Bilge Pumps
Pumps for every industrial use.

Albany Building uses 12,000 ft. of Chase Copper Tube for Radiant Heating!



International Brotherhood of Papermakers Bldg., Albany, N. Y. —12,000 ft. Chase Copper Tube supplied by Van Decar Harmon Co. Architect: H. O. Fullerton. General Contractor: James Smith. Heating Contractor: Frank J. Weber. (All firms of Albany, N.Y.)

Here's why

you too will want Chase Copper Tube in your Radiant Heating Installations!

EASY TO BEND
LONG LIFE
LONG LENGTHS
SOLDERED FITTINGS
LOW COST
LIGHT IN WEIGHT
SMALL DIAMETERS

FREE
Mail coupon for helpful design suggestions

IT'S A CINCH to install large radiant heating systems (and small ones too, of course) when you use Chase Copper Tube. Its flexibility and small diameter make bending by hand a simple matter. Because Chase Copper Tube comes in 60 and 100 foot lengths, relatively few joints are needed—and they're easily made with solder-joint fittings.

Chase Copper Tube also offers the advantages of light weight and long life.

Chase Brass & Copper Co.
Dept. HPA950, Waterbury 20, Conn.

Gentlemen: Please send your booklet "Suggestions for Designing Radiant Panel Heating with Copper Tube."

NAME _____ TITLE _____
FIRM _____
STREET _____
CITY _____ STATE _____

CHASE

Chase

the Nation's Headquarters for
BRASS & COPPER

WATERBURY 20 CONNECTICUT — SUBSIDIARY OF KENNECOTT COPPER CORPORATION

THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DALLAS DENVER† DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† ST. LOUIS SAN FRANCISCO SEATTLE WATERBURY (†Sales Office Only)

THESE TROUBLEMAKERS

IN PLANTS EQUIPPED with

CASH STANDARD Streamlined PRESSURE REDUCING VALVES TYPE 1000

THESE *Users* TELL WHY . . .

A Conditioning Corp. writes—

"Had a very critical job where it was important to HOLD CONSTANT PRESSURE TO VERY CLOSE TOLERANCES because we were using steam to reheat air to a set degree with allowed variation of less than one degree. Changed pressure reducing valves twice, then tried a CASH STANDARD Type '1000' and were able to accomplish the job."

A Maintenance Engineer says—

"I would be more than willing to recommend the performance of the CASH STANDARD Type '1000' Pressure Reducing Valve because we used the valve here UNDER ADVERSE CONDITIONS and found it PERFECT IN EVERY WAY—TROUBLE FREE and PRACTICALLY NO MAINTENANCE COSTS."

A Supt. of a Public Utility says—

"We operate a CASH STANDARD '1000' valve reducing steam pressure from 400 to 175 lbs. on our low pressure steam turbines' condenser air ejectors which is an important function and it has done the job WITHOUT FAILURE TO DATE."

A Tobacco Co. writes—

"We use only one '1000' valve in this department. It is used on the steam line to our Castle Autoclave (tough service). Our experience has been CONTINUOUS SMOOTH OPERATION for several years."

An Instrument Co. writes—

"Control of gasoline pressure on flo range of 5-4000 p. p. h. at 17½ psi. CONSTANT PRESSURE CONTROL over full range within 5%. This was on production test stands used for checking solid fuel injection on aircraft motors."

WRITE FOR BULLETIN 962

Note the benefits users say they get from their CASH STANDARD Type '1000' Pressure Reducing Valves.

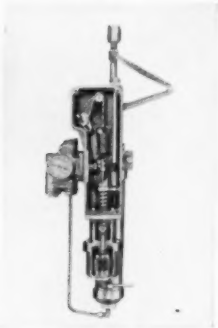
Check the benefits with this list

1. **Maximum capacity when needed most.**
2. **Accurate pressure control under toughest working conditions.**
3. **Trouble-free service.**
4. **Smooth operation.**
5. **Tight closure.**
6. **Speedier production results.**
7. **Elimination of failures.**
8. **Cost-saving operation.**
9. **No spoilage.**
10. **Practically zero in maintenance.**

CASH STANDARD CONTROLS . . . VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES
Send for them



Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers—various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.

Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve—direct operated—direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve—designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

New G-E control provides "double-check" protection against:

PILOT FAILURE
FLAME FAILURE
POWER FAILURE
CARBONIZING
COLD-OIL STARTING

COMPLETE OIL-BURNER PROTECTION . . . that's what you get when you specify General Electric's new photoelectric combustion control. It's a complete, coordinated system including master control unit, phototube holder and electrode holder. Assures positive protection against combustion failure by immediate fuel cut-off. All components of the system are easily removable for inspection and test without disturbing connections. Write for Bulletin GEA-4779: "Electronic Combustion Control for Commercial Oil Burners."

Development of this device is yet another proof that General Electric keeps abreast of commercial-burner needs with dependable electric equipment—including ignition transformers, motors and control. When you order oil burners, ask for complete electric equipment by General Electric. *Apparatus Dept., General Electric Company, Schenectady 5, New York.*

EQUIPMENT FOR COMMERCIAL BURNERS

IGNITION TRANSFORMERS

MOTORS

CONTROL

GENERAL ELECTRIC

THRUSH

Vertical FLOW CONTROL VALVE

WITH AIR TUBE

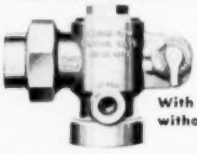
Threaded Union for Steel pipe or Solder Union for copper pipe as ordered.
FLOW
THRUSH FLOW CONTROL VALVE PAT. RE. NO. 19873
TO TANK
OPEN
SHUT
Lever Adjustment.

a New Design

TO SAVE FITTINGS, SIMPLIFY INSTALLATION

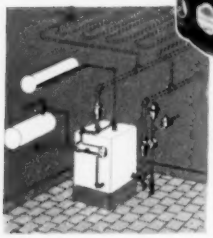
HERE IS the Vertical Thrush Flow Control Valve. It has the same proved dependable construction and offers all the advantages of the angle type Thrush Flow Control Valve, but in many installations the vertical valve will save fittings and simplify installation. Like the standard valve, it provides both flow control and air elimination without requiring any "air tube" fitting. The air is automatically separated as it rises from the boiler water and vented directly into the pressure tank. Water free of air passes up inside the tube.

Available with or without brass air vent tube.



With or without vent tube.

Angle type Flow Control Valve.



Thrush Horizontal Water Circulator.

YOU SAVE installation time and assure better heating plant operation for your customer when you install Thrush "T" Flow Control Valves. If you are not familiar with the Thrush Flow Control System and heating specialties, ask your wholesaler about them today or write us for price sheet and illustrated bulletin on Flow Control Valves. Address department E-9.

H. A. THRUSH & COMPANY, PERU, IND.

Fast Acting Fire Watchman

on duty 24 hours a day...
AT EACH FIRE HAZARD POINT

Let C-O-TWO safeguard your property from fire, even if you have a night watchman on duty. With a C-O-TWO Combination Smoke Detecting and Fire Extinguishing System you have an automatic, round-the-clock fire watchman that simultaneously guards each fire hazard point. The first trace of smoke in a protected area is drawn through pipes to a smoke detector. Immediately an alarm sounds . . . then fast, clean carbon dioxide gas fully floods the stricken area . . . the fire is out before it has a chance to spread and cause extensive damage.

Actual fire tests made by the Underwriters' Laboratories, Inc. show that fire detection with this type of smoke detecting equipment is much quicker than other methods . . . because usually there is smoke or smoldering before flames break out.

There is no water damage, no lingering odors with carbon dioxide . . . only damage is that actually caused by the fire itself. Carbon dioxide is clean, dry, non-conducting and non-damaging . . . harmless to finishes, materials and equipment. The fire is out in seconds, with hardly any interruption or commotion.

Remember fire doesn't wait . . . let an expert C-O-TWO Fire Protection Engineer advise you on your fire protection needs now, before fire strikes. Write today for complete free information!

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 • NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada
AFFILIATED WITH PYRENE MANUFACTURING COMPANY

Baltimore's giant new

FRIENDSHIP INTERNATIONAL AIRPORT

latest of the postwar super airports equipped with JENKINS VALVES

Architects & Engineers
WHITMAN, REQUARDT-GREINER COMPANY & ASSOCIATES, BALTIMORE, MD.

General Contractors
CONSOLIDATED ENGINEERING COMPANY, BALTIMORE, MD.

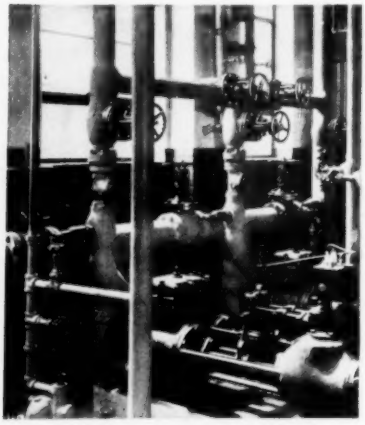
Heating, Plumbing & Air Conditioning Contractor
LLOYD E. MITCHELL, INC., BALTIMORE, MD.

The plane hasn't been built that is too big to land at Friendship International Airport. Nor is it likely to be. For in designing this new 3000 acre giant, formally opened by President Truman on June 24 to serve the Baltimore-Washington area, the keynote was expandability.

To Friendship's engineers, this meant not only providing for future passenger and cargo traffic, but selecting equipment on the basis of *long service life and safety.* That's why at Friendship, as in so many of the postwar air terminal and other large buildings designed with Tomorrow in mind, Jenkins Valves are installed.

Jenkins builds extra endurance into valves — proved time and again by low upkeep cost records in every type of service. Yet, you pay no more for Jenkins Valves, despite this extra value. Let the Jenkins Diamond be your guide to valve economy . . . for new installations, for all replacements. Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE.



BEHIND THE SCENE at Baltimore's $15 million Friendship International Airport, this view shows several of the 683 Jenkins Valves on 24-hour duty, policing steam, air, water and fire lines.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 — TRADE JENKINS MARK

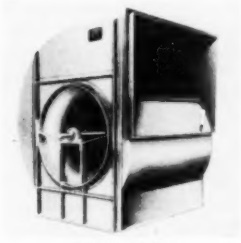
EQUIPMENT DEVELOPMENTS...

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1950 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

HPAC 1—CENTRIFUGAL FANS—The Trane Co., La Crosse, Wis., has developed a completely new and expanded line of centrifugal fans which are said to be the result of more than two years of intensive design, product engineering and laboratory testing work.

According to the manufacturer, features include unusual mechanical efficiency, quiet operation and durability. The low brake horsepowers required in proportion to the volume of air discharged and the unusually low noise level are said to be the result of: streamlining of inlets to reduce turbulence and air friction; the use of newly calculated and tested blade angles, depths and widths; balancing of all fan wheels; low outlet velocity and maximum outlet area for each size; and the use of heavier gage metals, rigid bracing and sturdy construction.

The line includes forward curved (FC) fans in 21 sizes from 12 to 89 in. wheel diameters and backwardly inclined (BI) fans in 23 sizes from 12 to 109 in. wheel diameters. Each size is manufactured in single and double widths and in both Class I and Class II construction.



Centrifugal Fan

Recorder-Controller

HPAC 2—RECORDER-CONTROLLER—A new and improved proportional action recorder-controller, for use in many of the processing industries and in all applications where a record of controlled temperatures is desired, has been developed by Johnson Service Co., 507 E. Michigan St., Milwaukee 2.

Called the "Record-O-Stat", the new unit is designed to control either air or liquid temperatures. It may be operated as either a direct or reverse acting controller to suit the requirements of the application. Sensitivity of control action may be adjusted by varying the throttling range, which is adjustable up to 100 percent of the chart range.

For exacting applications, the device is available with an automatic reset feature designed to coordinate the deviation in control with the various thermal lags inherent to the system being controlled. This feature is said to virtually eliminate any deviation of the control point from its set value. The entire temperature measuring system (bulb, capillary tubing, and high-torque helical element) is liquid filled.

Five standard 12 in. charts with various temperature ranges between 0 and 250 F are offered and elements with suitable charts for operation at other ranges between 125 and 400 F are available on special order.

HPAC 3*—SUSPENDED AIR HEATER—Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, has developed a new direct fired air heater of the suspended type. It is an oil fired unit incorporating a stainless steel combustion chamber, corrugated flues of 12 ga steel plate, and a steel inner liner.

Another important feature, according to the company, is the fact that the unit can be converted from a suspended type to a floor installation by standing the unit in an upright position and turning the burner, controls, and inspection plate 90 deg.

FOR YOUR CONVENIENCE [9-50]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34						
101		103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118		120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	

Name ..... **Title** .....

Company .....

Address .....

City ..... **Zone**.... **State**.....

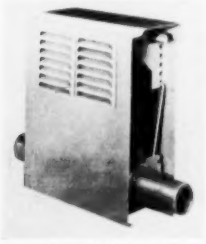
HPAC 4—DIRECT FIRED AIR HEATERS—Thermobloc Div., Prat-Daniel Corp., East Port Chester, Conn., has added two new, small capacity models to its line of "Thermobloc" self-contained, direct-fired industrial heaters.

The new models, called "Thermopac" type, are made in 100,000 and 200,000 Btu per hr output capacities for either gas or oil firing. They are fired either by atmospheric gas burners or pressure atomizing type oil burners and may be floor set, wall hung or horizontally suspended.

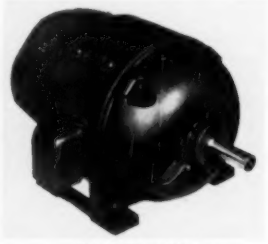
HPAC 5—BASEBOARD CONVECTORS—The new "High Output" baseboard convector, now available from Kritzer Radiant Coils, Inc., 2901 W. Lawrence Ave., Chicago 25, is designed for location where high Btu output is desired. According to the manufacturer, the unit is ideal for drafty spots, such as beneath windows, or where extra heat is needed to supplement a radiant panel system. It is also recommended for use in modernization jobs, as it is unusually compact.

The unit is relatively tall and is said to create a chimney effect within itself, thus providing increased convection to augment the warmth of radiant heat which emanates from the baseboard outer surface.

Collared steel fins mechanically bonded on a steam pipe constitute a heating "coil". The extended surface afforded by the fins is said to result in an exceptionally efficient heat transfer unit. The coil is hung on a bracket attached to a back-plate, while a louvered front plate is napped into place, enclosing the coil from the front. Provision is made for adjustment of the pitch of the coil to allow gravity return of steam condensate to the boiler. The new baseboard convector is made in standard lengths up to 10 ft with 1, $1\frac{1}{4}$, or 2 in. steel pipe, and 1 in. or $1\frac{1}{4}$ in. copper pipe.



Baseboard Convector



Single Phase Motor

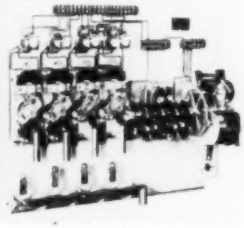
HPAC 6—SINGLE PHASE MOTOR—For use where a constant speed, high torque, single phase motor is required in large ratings, a new repulsion-induction motor has been announced by the small and medium motor divisions of General Electric Co., Schenectady 5, N. Y. An addition to the company's "Tri-Clad" line, the new motor is said to combine the high starting torque of the repulsion motor with the constant speed characteristics of the induction motor.

Designated as type SCR, it is available in 5, $7\frac{1}{2}$, and 10 hp ratings, all 1800 rpm. The 5 hp unit operates on 115 230 volts, while the other two use 230 volts. Typical applications are said to include air and refrigeration compressors, pumps, stokers, etc.

HPAC 7—CEILING AIR DIFFUSER—Designed for installation where the outlet cannot be recessed into the ceiling, the new JS and JSC air distribution outlets of Barber-Colman Co., Rockford, Ill., are said to incorporate adjustable air deflection and a high aspiration rate.

Outlets extend only a few inches above the ceiling surface. The "Venturi-Flo" units are available as supply or combination supply and return outlets. Supply air deflection is adjustable from vertical to horizontal in supply outlets and is limited in combination units to prevent short circuiting of supply air to the return opening.

Diffuser



Pump Control

HPAC 8—PUMP CONTROL—The new "Pressureflo" control of Builders-Providence, Inc., 345 Harris Ave., Providence 1, R. I., may be used to start and stop pumps, to increase or decrease the speed of one or more pumps, to maintain a predetermined pressure at any point or district on a distribution system, or to automatically adjust pressure and flow to suit varying demands. These are said to be but a few of the many possible applications in the pumping of water, sewage, oil or gas or the transmission of other liquids.

The device consists of a flow-determining means, a pressure or level sensing device and a mechanism to translate this "information" into a control function. Other equipment consists of standard components plus a special control device to convert flow and pressure into pump response.

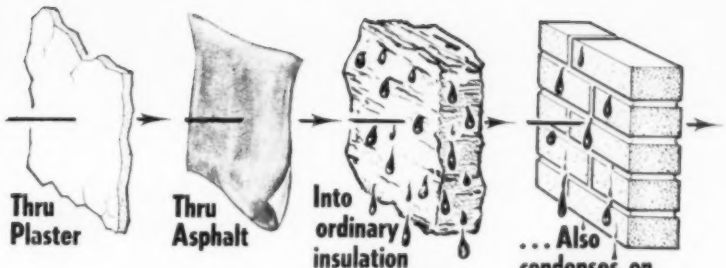
HPAC 9—COOLING TOWERS—A new series of induced draft cooling towers, for use with self-contained refrigeration and air conditioning equipment, is now available from Acme Industries, Inc., Jackson, Mich.

Designed for indoor or outdoor application with external duct resistance of $\frac{1}{4}$ in. or less, the models are designated as TCJ-2, 2A, 3 and 3A. These models are for use with units up to and including 5 hp and have fans located at the top to provide vertical air movement across the filling. Air is discharged horizontally at a velocity said to be sufficient to prevent recirculation.

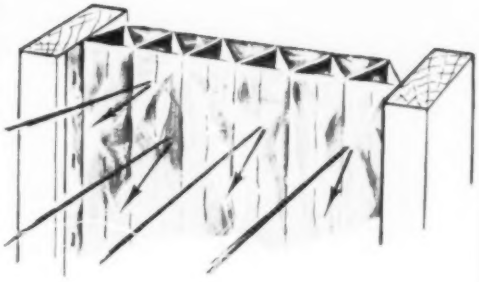
The company states that present models are not furnished with pumps because so many of these towers are being applied to existing systems and the pumping heads vary considerably, requiring individual pump selection. However, connections are provided to permit the use of an attached pump.

[Continued on page 200]

Vapor Flows



Vapor does not flow thru nor condense on outer or inner surfaces or reflective air spaces of multiple sheet accordion aluminum.



Water vapor is a gas. At 32° its density is 1/200,000th that of water so that it can sieve through asphalt, plaster, and most other building materials. Cold ordinary insulation and cold outer walls, below the dewpoint temperature of the vapor, cause it to condense.

Tough aluminum is impervious to water vapor and yet has insufficient mass to extract heat from contacting air before reaching equilibrium in temperature with it. Colder air can support less vapor, and is an important cause of condensation.

In addition, multiple accordion aluminum repels 97% of heat rays, emits only 3%, and is also an excellent block to conduction and convection. This construction is commercially available as Infra Insulation Type 4 and Type 6, costing less than 7½¢ and 9¢ sq. ft. respectively, material with labor, installed between wood joists in new construction.

"Simplified Physics of Vapor and Thermal Insulation," an authoritative and simply written brochure which has proved of value to architects, engineers, builders and contractors, teachers and officials, may be obtained free by filling out the coupon below.

THERMAL FACTORS, TYPE 4 INFRA

Down-Heat C.064, R15.62 equals 5" DRY Rockwool
Up-Heat C.109, R 9.17 equals 3" DRY Rockwool
Wall-Heat C.105, R 9.52 equals 3½" DRY Rockwool
VAPOR PERMEABILITY equals ZERO

INFRA INSULATION, INC.
10 Murray Street New York, N. Y.
Telephone: COrtlandt 7-3833

INFRA INSULATION, INC.
10 Murray Street, New York, N. Y. Dept. H-9

Please send "Simplified Physics of Vapor and Thermal Insulation."

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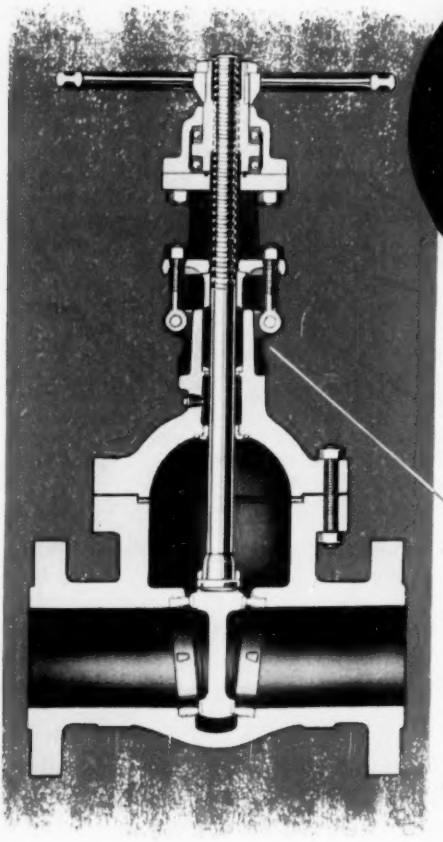
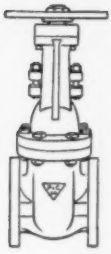
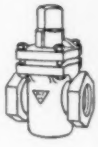


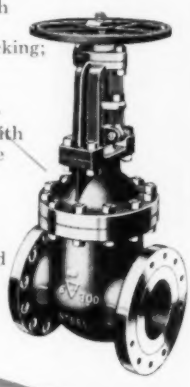
R·P&C CAST STEEL VALVES





Note the **quality features** of this Gate Valve. They are typical of all valves in the R-P&C Cast Steel Line—gate, globe, angle and check valves in pressure classes 150 lb. through 1500 lb.

- **Ball Bearing Operating Nut** permits smooth operation with minimum effort.
- **One Piece Yoke with Cap** provides rigidity, perfect alignment and easy access to operating nut.
- **High Quality Packing** assures a tight stuffing box under all conditions—low stem friction—minimum servicing.
- **Gland and Follower with Ball Joint** applies uniform pressure on packing, prevents follower binding with stem.
- **Heat-treated Stainless Steel Stem** has high strength and corrosion resistance. Polished surface increases life of packing; T-head makes strong, self-aligning connection with wedge.
- **Solid I-Beam Wedge** is guided to proper seating by guide ribs cast integral with the body. Wedge seating surfaces are precision ground to fit perfectly with body seat rings.
- **Barrel-type Seat Rings** have heavy, uniform section; offer no points of high stress concentration; have broad seating surface, ground smooth for less wear—longer life. Port opening is full pipe diameter.



***In addition** to the standard line, R-P&C offers cast steel gate and globe valves with Pressure Sealed Bonnet joint—especially adapted for high pressure, high temperature service. For information, get in touch with your nearest R-P&C District Office.*

ACCO Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Connecticut

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

READING-PRATT & CADY VALVES

Ladish Elbows

...A Complete Size Range Another Reason to Specify *Controlled Quality*

SEAMLESS WELDING FITTINGS

From the small fitting that weighs several ounces to the half-ton giant . . . whatever your fittings requirement, the Ladish line provides you with an unrestricted choice of sizes in a complete range of types, weights and materials. In addition, every fitting offers the added dependability assured by the high manufacturing and metallurgical standards of Ladish Controlled Quality.

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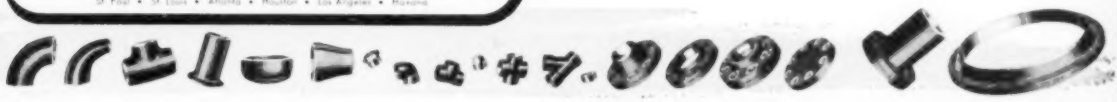

"I wasn't asleep," said the Dormouse

EVERY boy and girl knows the drowsy Dormouse of Alice in Wonderland. He was elbowed and pinched by the Mad Hatter and the March Hare as he mumbled in his sleep at the tea party.

But our young people aren't so well versed in everyday economics. They have a sadly distorted picture of the profits of business. They don't realize why profits are necessary, how small they are, or how they are divided.

For instance, in a recent survey of high school seniors, it was discovered that they believe over 50% of the sales dollar is profit and they think stockholders receive 24% of it. Actually business profit averages less than 8%, with less than 3% distributed as dividends. Business uses most of its profit, moderate as it is, for new plant and equipment, to improve products and to make more jobs.

Misconceptions among our youth bode ill for America's future. They open the door for too ready acceptance of dangerous isms and false foreign philosophies. Such misunderstanding of economics can be corrected only with facts supplied by business itself. You as a leader in your community must share this responsibility.

The American business man must not allow himself to be cast in the role of the Dormouse, pinched and pilloried by the March Hares of communism and the Mad Hatters of the "everything for nothing" state.

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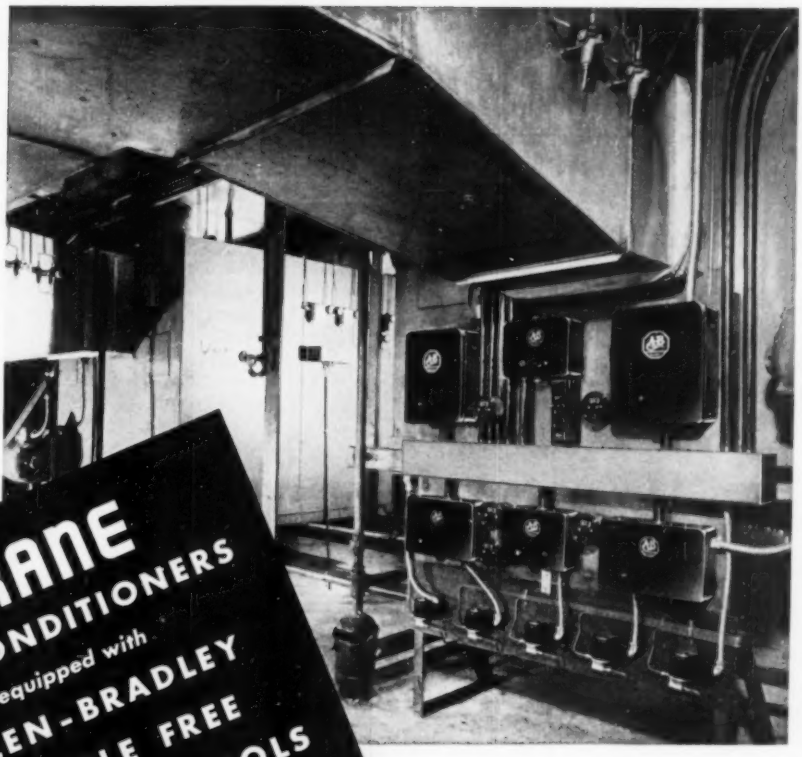

Part of the controls for five climate changes built by the Trane Company and installed at the Ladish Company, Cudahy, Wisconsin. The starters are all Allen-Bradley Bulletin 709, Form 2 T (with control transformers). The white interior common to all Allen-Bradley enclosures makes the installation job an easy one, even where lighting conditions are bad. The push button station is an Allen-Bradley Bulletin 800, Type 2 HAP, start-stop station, with indicating light.

TRANE
AIR CONDITIONERS
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ALLEN-BRADLEY
TROUBLE FREE
MOTOR CONTROLS

A-B
Quality

Why are Allen-Bradley starters so popular for air-conditioning service? . . . Because they do not require regular attention, they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

No contact maintenance . . . Allen-Bradley patented silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are dependable and remain accurate in their operation, even after long service.

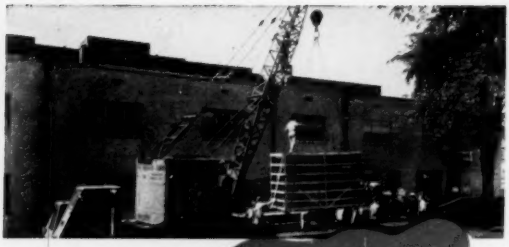
The Allen-Bradley trademark stands for millions of trouble free operations.

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.

BULLETIN 709
SOLENOID STARTER

Bulletin 709 solenoid starter for automatic across-the-line starting of squirrel cage motors. These starters are built in eight sizes, having a maximum rating of 300 hp, 208-220 v; 600 hp, 440-550 v. Dependable relays provide accurate overload protection. No voltage protection. White interiors and ample space for ease of wiring.

ALLEN-BRADLEY SOLENOID MOTOR CONTROLS



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ON AIR CONDITIONING

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Save water! Save space! Save installation time and money! Save operating costs! Yes, install Governair and *save from $50 to $200 for each ton* of the completely packaged Governair unit designed to fit your needs!

Experience proves Governair can save you up to $5,000 on a 50-ton Governair unit that gives greater dependability and more "engineered efficiency" than ever before!

If you want the best — if you want the most economical and reliable air-conditioning unit on the market . . . CHOOSE GOVERNAIR and SAVE!

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MANUFACTURERS OF COMPLETELY PACKAGED AIR CONDITIONERS

GOVERNAIR

UNIT COOLERS

GOVERNAIR CORPORATION • 513 N. BLACKWELDER • OKLA. CITY

[Continued from page 194]

HPAC 10—CRANE CAB CONDITIONERS—Two new types of crane cab conditioners, developed by Dravo Corp., Dravo Bldg., Pittsburgh 22, are designed to provide ventilation, heating, and dust and fume protection.

The Model VHDF is designed to provide continuous ventilation, heating, dust filtering, and fume protection for crane cabs and small confined spaces in industrial plants. The other unit, Model VHD, performs the same functions except for fume removal. This model is intended for use where noxious fumes are not a problem.

The fan sections of both units can be rotated 90 deg for continuous discharge of air from the top or either side, and in addition, they can be installed in a horizontal, vertical or inverted position. For cold weather operation, air brought into the unit is heated by electric strip heaters maintaining temperatures of 68 to 72 deg. Either unit will operate on a-c or d-c power.

Cab Conditioner

Tubing Fastener

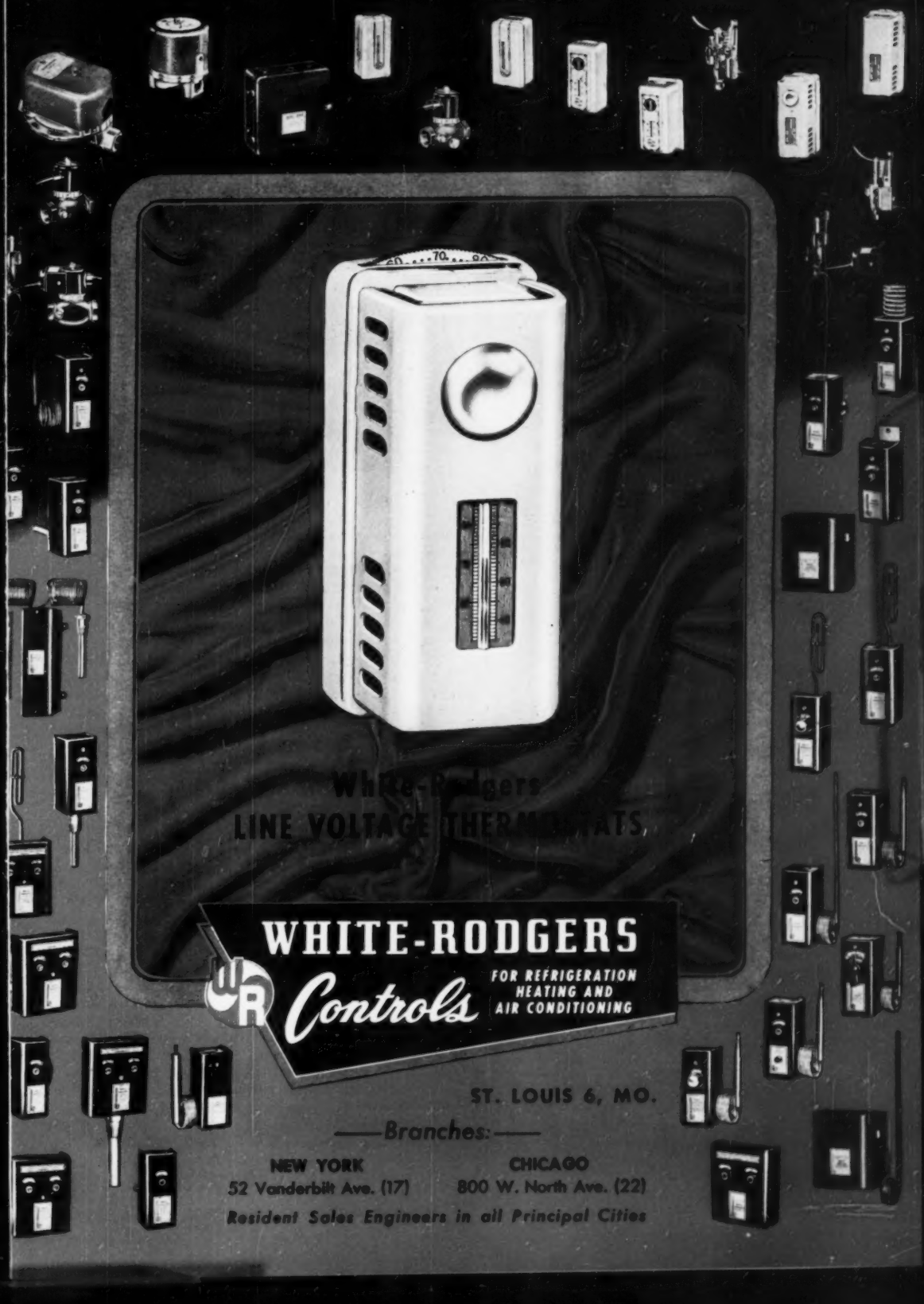
HPAC 11—TUBING FASTENERS**—"Tube-Tite" staples, made by E. H. Titchener & Co., 67 Clinton St., Binghamton, N. Y., are designed to fasten copper and brass tubing used in radiant heating, hot and cold water service lines, refrigeration piping, etc.

They are made in three sizes from copper but have a steel core. The three sizes are designed to fit $\frac{3}{8}$, $\frac{1}{2}$, or $\frac{3}{4}$ in. nominal tubing. For the first two tubing sizes a flat type staple made from flat stock has been designed. For the largest size, a round wire staple with a round top is used. The copper surface of the staples is said to eliminate any galvanic action between the staple and copper or brass tubing.

HPAC 12—RUBBER LINED VALVE—Developed for resistance against erosion and abrasion in the control and tight shutoff of either slurries or dry pulverulent materials in air transport pipe lines, 50 lb valve No. 737 can be completely rubber lined. The manufacturer is R-S Products Corp., Wayne Junction, Philadelphia 44.

Hard or soft natural or synthetic rubber, depending upon the material to be controlled, is sealed to the valve vane as well as the valve body. According to the company, the angular seating vane (for wedge type closure) permits the soft rubber to be compressed around the periphery of the vane so as to give tight shutoff, even around the shaft bosses.

Manual and automatic prime movers of all types are available for control and sizes range from 2 to 72 in. The temperature range is from —40 to 275 F.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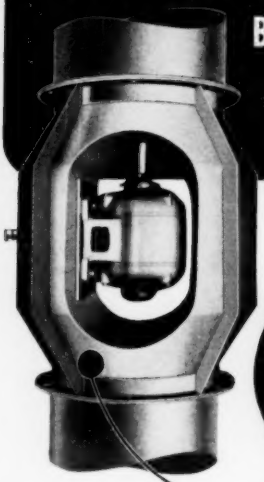
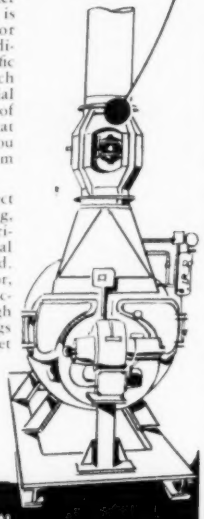


SOLVE DIFFICULT STACK PROBLEMS THIS ECONOMICAL WAY

Let DeBothezat's trained engineers recommend the right Induced Draft Bifurcator Fan for your particular boiler application. DeBothezat fan selection is not based merely on boiler HP or pounds of fuel fired per hour. In addition, consideration is given to specific temperatures, the resistance of each boiler to airflow, and other confidential data furnished on each make and size of boiler by the manufacturer. DeBothezat eliminates guesswork and assures you of the correct size fan for maximum efficiency.

The DeBothezat Bifurcator is a direct motor-driven fan with a divided housing, easily installed in vertical stack or horizontal or angular breeching. No special platforms or supports are required. Gases are by-passed around the motor, which remains cool, clean and easily accessible. Standard fan sizes 12" through 27", for boilers having nominal ratings up to 850 BoHP, or 49,000 square feet of radiation.



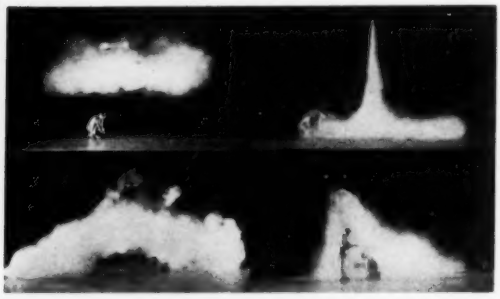
SEND FOR FREE BULLETIN

See how the DeBothezat Induced Draft Bifurcator Fan works. Descriptive illustrated bulletin is yours without obligation. Address Dept. H950.

De BOTHEZAT FANS DIVISION
AMERICAN MACHINE AND METALS, INC.
EAST MOLINE, ILLINOIS

HPAC 13—UNIT HEATER AIR DIFFUSERS—The new "Louver Cone" diffuser for projection type unit heaters and the "Louver Fin" diffuser for horizontal type unit heaters have been developed by The Trane Co., La Crosse, Wis., to solve diffusion problems on the job by a simple adjustment. They are also said to eliminate the necessity for moving heaters and piping to accommodate changes in floor layout.

By "fingertip adjustments" of the new diffusers, using no tools, heated air may be directed in an almost "infinite variety" of useful patterns.



The units for projection type unit heaters have 24 adjustable blades fitted between a die cast hub and a cone-shaped spun steel rim. The diffuser for horizontal type heaters generally has seven horizontal and 56 vertical blades. According to the manufacturer, the new diffusers greatly simplify the problems of determining the exact location, size and combination of types of unit heaters for any given floor area, because they may be used to concentrate the flow of heated air in an unusually long column and because they may also be used to split the output of heated air two or more ways.

In the illustration, smoke tests are used to show several of the many diffusion adjustments for the projection type unit. A similar variety of patterns may be obtained with the unit designed for horizontal heaters.

HPAC 14—BRONZE GLOBE VALVES—Jenkins Bros., 100 Park Ave., New York 17, have introduced a new rapid-action, bronze levered gate valve with construction features designed to insure maximum tightness and long life.

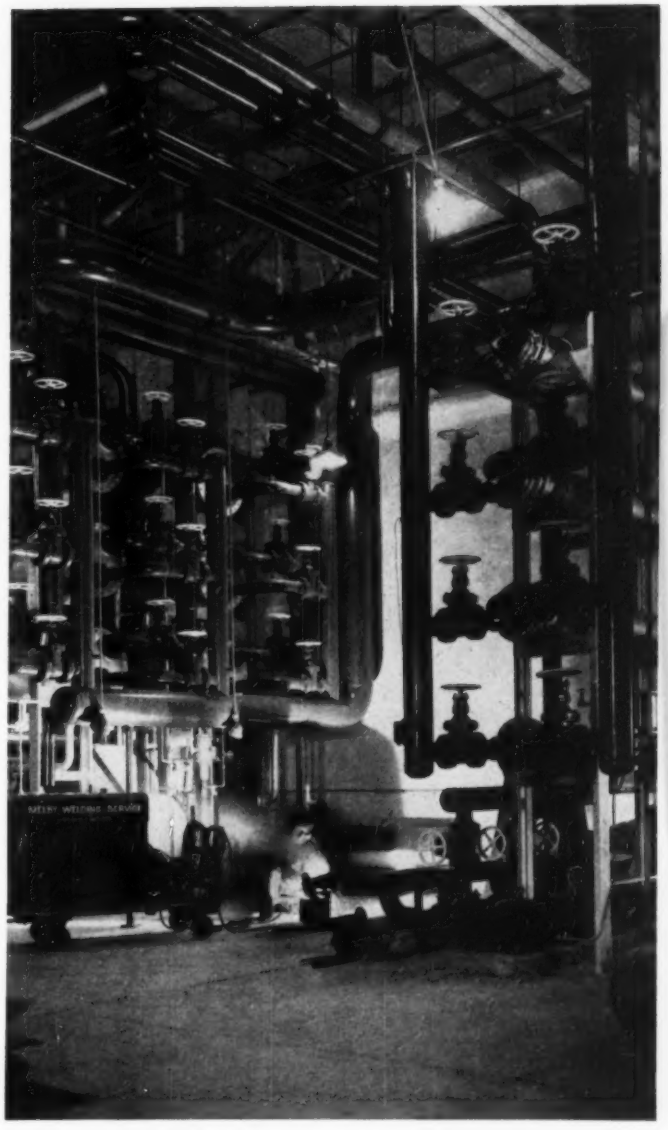
The "Swingtite" valve has ball and socket design double discs which are said to adjust readily to seat surfaces. Guide rims on these discs rotate on the guide tracks cast in the body, as the valve opens or closes. This roller action is said to provide a self-cleaning and polishing effect and to distribute the wear, since the seating position of the discs changes with each closing. In addition, the rolling disc and track construction is said to insure more accurate seating with continual tight closure and to prevent rapid uneven wear of the discs. The spindle is of manganese bronze and the malleable iron lever can be placed in four different positions with relation to the spindle to suit installations.

The valve is rated for 125 lb steam service, 300 lb cold oil, water, and gas, and is made in $\frac{1}{2}$ to 2 in. sizes. It is especially recommended for use in oil refineries, textile finishing, chemical and food industries, paper and pulp mills, laundries, etc.

Packs More Pipe into Less Space...in Less Time with Lincoln "Shield-Arc" and "Fleetweld" Team

IN the recent installation of over 80,000 feet of pipe for the Alford Refrigerated Warehouse at Dallas, Texas, many space limitations have been efficiently overcome by the use of all welded pipe construction. Heat exchange lines, discharge lines and discharge surge drums are all heavy wall pipe welded to welding elbows and reducers, thus making possible the confinement of more pipe in restricted areas.

Almost every joint had to be welded in position. To assure the fast production of uniform, porous-free welds of proper strength and penetration, these connections were made with 3 passes of Lincoln "Shield-Arc" DC engine driven welders. All pipe connections were tested at 85 pounds per square inch and found to be completely pressure-tight.



GET THE FACTS

Send for Bulletin 403, Lincoln Welding Guide, write

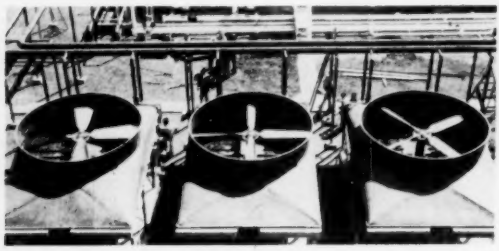
THE LINCOLN ELECTRIC COMPANY
Dept. 284, Cleveland 1, Ohio

Sales Offices and Field Service Shops in All Principal Cities

LINCOLN

HPAC 15*—AXIAL FAN—Now available from Aeromatic Propeller Dept., Koppers Co., Inc., Baltimore, Md., is a new industrial type axial fan employing aerodynamic design principles and aircraft production techniques.

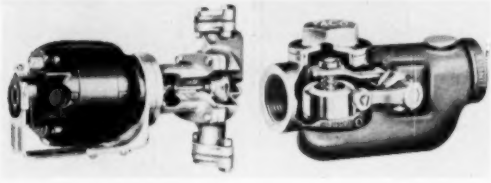
The new "Aeromaster" fan is applicable to engine jacket water coolers for natural gas, gasoline, or diesel engines; vertical air discharge condensing units; various oil field and power utility air coolers and water coolers; and large air conditioning systems.



The largest of the new fans, 20 ft in diameter, is capable of delivering 500,000 cfm and is designed for continuous, open air operations. The fans are manufactured in sizes ranging from 6 to 20 ft in diameter. According to the manufacturer, blades are designed according to standard aircraft airfoil procedure but the blade profile is modified from the aircraft shape to better adapt it to move a large volume of air at a minimum of horsepower rather than the development of high thrust. The fan blade core is made of laminated birch, bonded with the company's "Penacolite" resins. A plastic cover is applied to the birch in order to provide resistance to weather and abrasion, as well as a minimum of friction.

In the illustration, each of the 14 ft fans is capable of delivering 275,000 cfm. The cooling towers shown were recently installed at an oil refinery in Oklahoma.

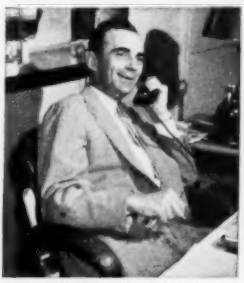
HPAC 16—HOT WATER CIRCULATOR AND FLOW VALVE—A new circulator for forced hot water heating systems and a horizontal flow check valve have been developed by Taco Heaters, Inc., 137 South St., Providence 3, R. I.



The new HDH circulator is supplied with $\frac{3}{4}$, 1, $1\frac{1}{4}$, or $1\frac{1}{2}$ in. interchangeable flanges and is designed to pump 20 gpm against a 10 ft head regardless of flange sizes used. Said to be exceptionally quiet in operation, it is equipped with a porous bronze bearing, rotary seals, a cast bronze balanced impeller with a stainless steel shaft, a rotatable body, and two-bolt interchangeable flanges.

Used to prevent hot boiler water from flowing to the heating system when a circulator is not running, the flow check is available in 1, $1\frac{1}{4}$, $1\frac{1}{2}$, 2, $2\frac{1}{2}$ and 3 in. sizes. It consists of a machined weight and seat, a bronze spring cushion, bronze working parts, a three position (open,

These men are working for you



Energetic, keen-minded JOHN G. SEILER, Tube Turns' Executive Vice-President and General Sales Manager, keeps a sensitive finger on the pulse of your piping needs.

Solid, wiry JOHN W. GREEN, Sales Manager of Tube Turns' Fittings Division, arrives in New York for confab with Eastern representatives.

Rangy, quick-smiling THOMAS H. PIKE, Jr., Assistant Sales Manager of Tube Turns' Fittings Division, awaits flight call for personal check on West Coast piping picture.

JOHN E. CHUMBLEY, slender, youngish Sales Manager of Tube Turns' Forgings Division, makes frequent field trips that pay off in better products, faster service.

MOST travel-minded group of American businessmen today are sales executives. Covering millions of air, rail, and highway miles each year, these modern Marco Polos have chucked the Ivory Tower attitude of their predecessors.

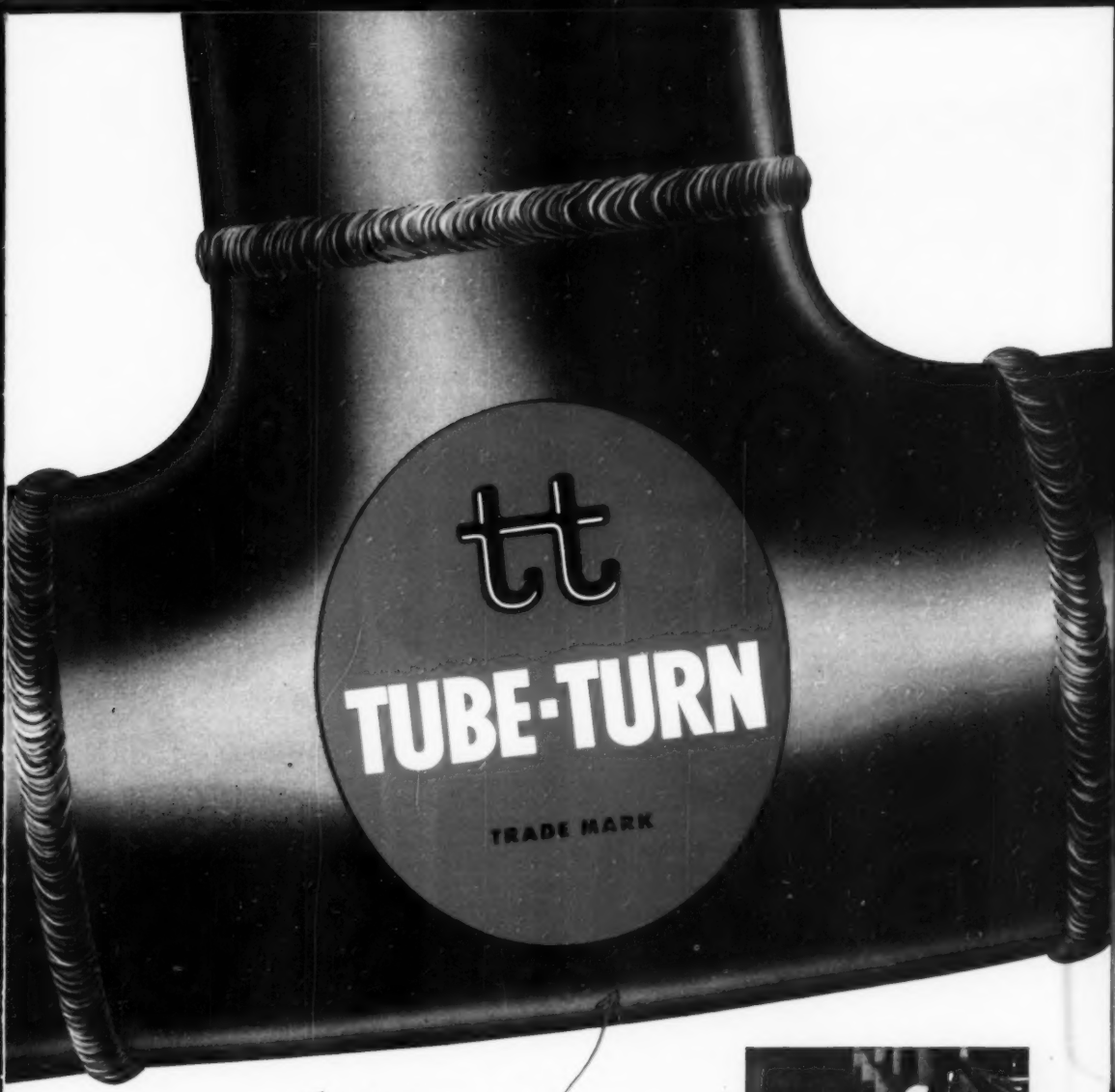
Like many another sales management team, John Seiler, Jack Green, Tom Pike and John Chumbley look upon service as the father of sales. "Our customers are smart," confides Seiler. "They don't just *buy*, they *discriminate!* Field trips are the best way I know to find out how we can serve them better. It takes plenty of leg work in this business. Your customer can usually give you some pretty solid ideas on product improvement. We've prospered because we listen to what he says . . . *in person!*"

Some 2200 distributor salesmen, the sales-engineering staffs of Tube Turns' 8 district offices, and the finest group of piping technicians in the industry, follow this customer-service policy to the letter. Results: Tube-Turn welding fittings and flanges are the best in the company's history; Tube Turns' customers get qualified help in utilizing its products more and more profitably.

"Be Sure You See The Double tt"

TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY



In all the world there's only one TUBE-TURN Welding Fitting as shown by this trade mark... the right mark for every need in welding fittings and flanges.

Your nearby TUBE TURNS distributor can serve you right from stock. Call him for prompt delivery.

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Call your Carey representative today. He's a trained expert who is eager to serve you.
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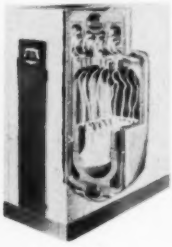
CAREY Makes The Complete Line { 85% Magnesia—Industrial Rock Wool Asbestos—Pipe Coverings—Sheets—Blocks—Batts—Papers—Air-Cell

Write for your free copy of "Heat Insulation For Industry." Address your request to Dept. H-9. The Philip Carey Manufacturing Company, Cincinnati, 15, Ohio. In Canada: The Philip Carey Company, Ltd., 1557 MacKay Street, Montreal 25, P. Q.

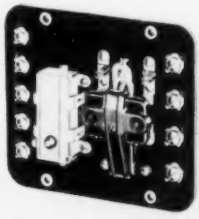
closed and normal) adjustment and a seat which can be cleaned by moving the adjustment lever up and down with the circulator running.

HPAC 17—CAST IRON BOILERS—The new US-12 boiler of United States Radiator Corp., 300 Buhl Bldg., Detroit 26, is a cast iron unit, manufactured for steam or hot water in four sizes and in four models. It is offered as an oil burner-unit, an oil-fired boiler without burner, a gas-fired boiler and a coal-fired boiler. Its rated output is from 58,000 to 128,000 Btu per hr.

Unique fins and baffles are said to make the boiler a highly economical heating plant suitable for small building applications of all kinds, including commercial, institutional, industrial, etc.



Boiler

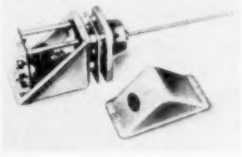


Oil Burner Control Relay

HPAC 18—OIL BURNER CONTROL—A new two-piece stack control in which the primary relay is an integral part of the oil burner presents many unusual advantages, according to the manufacturer, Penn Electric Switch Co., Goshen, Ind.

The primary relay is factory installed and completely prewired. The second unit is a simplified combustion control requiring only low voltage wiring. Advantages are said to include simplification of the electrical hook-up and the fact that location of the stack switch reset button on the burner makes access to the stack unnecessary after installation.

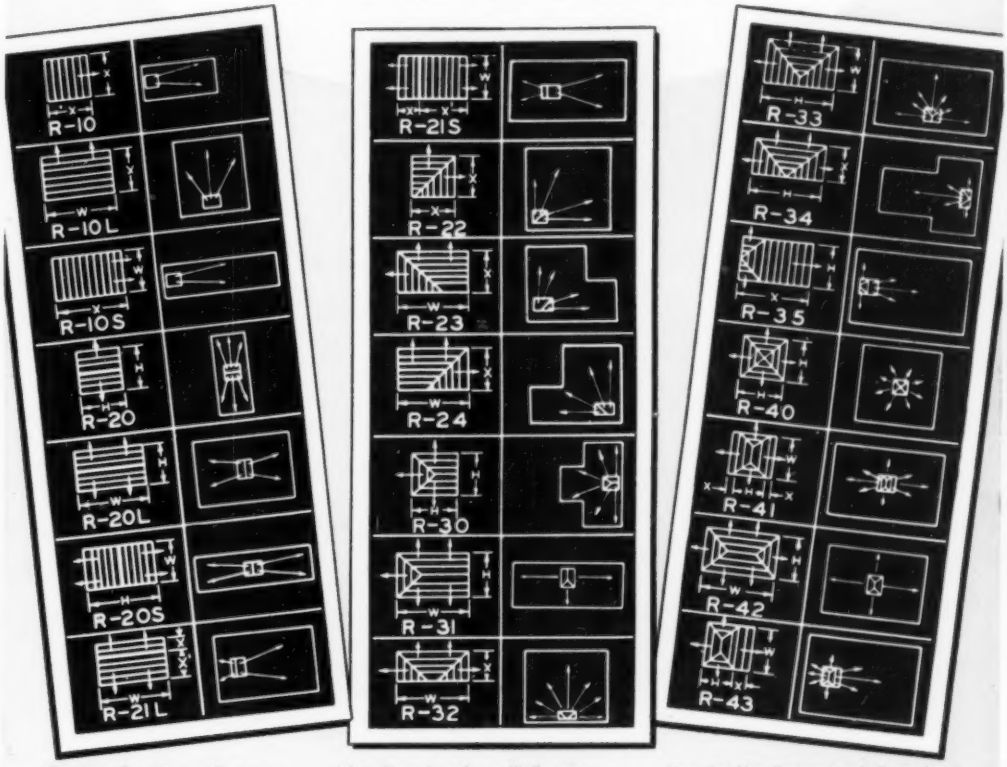
HPAC 19—GAS BURNER COMBUSTION SAFEGUARD—Combustion Control Corp., 77 Broadway, Cambridge 42, Mass., has introduced "Fireye" system FF-6 to provide electronic flame failure protection and semi-automatic ignition control for all types of commercial and industrial gas burning equipment.



The system includes an electronic flame rod (type 45JQ1) and a control (type 24QJ5). The flame rod is mounted near the gas pilot on the burner plate and projects into the fire chamber. The rod is so located that its tip impinges on the pilot or main gas flame. When flame fails, the rod signals this condition to the control which cuts off fuel and which can be wired to sound an alarm. An important advantage is said to be that the unit responds to the flame itself, not to any secondary effect of the flame.

AGITAIR®

THE ONLY AIR DIFFUSER *Tailor-Made* TO SUIT CONDITIONS OF EACH APPLICATION



Center of ceiling, off-center . . . sidewall or baseboard? Square, rectangular . . . "L" or "T" shaped? Low ceilings, high ceilings . . . long, narrow or wide corridors? Yes—whatever the air distribution problem, you'll find the answer is Agitair. It's the only diffuser that gives complete freedom of design, yet assures 100% air distribution without the use of makeshift blank-off's or oversized outlets. The applications above give you some idea of the amazing versatility of Agitair square and rectangular air diffusers. You design the room and we'll help select the Agitair pattern most suitable for the location you desire.

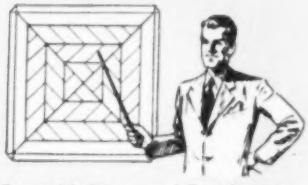
Write for Complete Data

AIR DEVICES, INC.

17 EAST 42nd ST. • NEW YORK 17, N. Y.

AIR DIFFUSERS • AIR FILTERS • ROOF EXHAUSTERS

Here's the Secret of Greater Diffusing Ability:



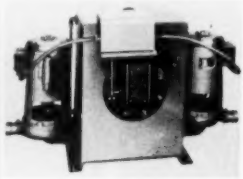
Patented built-in vanes deflect the air in numerous divergent streams resulting in turbulence at the point of contact with the aspirated air. Result: Rapid mixing, diffusion and temperature equalization.

THE DIFFUSING VANES MAKE THE DIFFERENCE

HPAC 20—ROOM COOLER—A new streamlined "plug-in" room air conditioner is available from Frigidaire Div., General Motors Corp., Dayton 1, Ohio.

Designed to fit any conventional double hung window from 23 to 56 in. wide, the unit has a ½ hp sealed rotary, "Meter-Miser" compressor, a condenser of aluminum finned copper tubing and a three row finned cooling unit of the same general construction. Individually adjustable louvers may be used to direct air up or down and steel vanes on the chassis control the flow of air to the right or left as desired. The unit will circulate 220 cfm and will handle 40 cfm of outside air. The disposable filter may be replaced through the bottom of the cabinet.

Room Cooler



Condensation Pump

HPAC 21—CONDENSATION PUMP—A new, more compact condensation pump, known as the type CHV, has been placed on the market by C. A. Dunham Co., 400 W. Madison St., Chicago 6.

Said to be unusually compact, rigid, and sturdy, units are anchored to the floor with but two bolts, the design eliminating the need for bed plates and bars. Electric motor units are supported by the copper-bearing steel tank. Motors are mounted well above the floor level, affording added protection from surface water and splash of floor cleaning operations.

The pumps are ready for operation after piping and wiring connections are made. They are offered in single or duplex units, in capacities from 2030 to 20,000 EDR.

HPAC 22—CENTRIFUGAL PUMPS—Goulds Pumps, Inc., Seneca Falls, N. Y., is offering a new line of self-priming, centrifugal pumps, made in sizes from ¼ to 5 hp, open and closed impellers.

Designed for capacities up to 120 gpm and heads up to 135 ft, depending upon capacity, the new pumps are said to provide unique advantages, including efficiencies comparable to standard centrifugal pumps and the fact that water is not recirculated during the pumping stage.

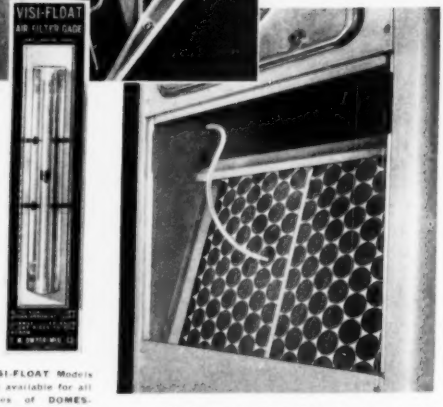
HPAC 23—AIR-GAS MIXING VALVE—Accuracy of air-gas mixing and versatility of application are said to be the two outstanding features of the "McKee Consta-Mix" proportioning valve now available from Eclipse Fuel Engineering Co., 767 S. Main St., Rockford, Ill.

The unit is recommended for brazing and soldering operations, flame hardening, small furnace heat require-

Sell Them **CLEANER AIR** and **MORE OF IT**

with DWYER VISA-FLOAT AIR FILTER GAGE

for WARM AIR FURNACES UNIT AIR CONDITIONERS AIR CONDITIONING SYSTEMS



VISI-FLOAT Models are available for all types of DOMESTIC, COMMERCIAL AND INDUSTRIAL APPLICATIONS.

- Help your customers to eliminate the ever-costly problem of clogged, dirty filters, a major cause of inefficient air supply. Recommend the Dwyer VISI-FLOAT Air Filter Gage for every air-conditioner, heater or ventilator you sell or service. The Dwyer VISI-FLOAT checks filter condition permanently and constantly right on the face of the unit. It indicates the moment of overload, the time to change or clean filters. It assures more and cleaner air, reduced fuel bills and blower trouble.

Accurate, Compact, Fool-Proof and Inexpensive

The Dwyer VISI-FLOAT consists of a red float inside a transparent, acrylic plastic gage glass, mounted to a metal indicator plate.

FLOAT Reacts Instantly to Pressure Drop

The VISI-FLOAT is installed easily and quickly on the outside of the unit, across the filters. Then, as the difference or drop in air pressure from above filter to below filter is increased, the float rises. When it rises to or above the red arrow it's time for filter replacement or cleaning.

The VISI-FLOAT is convenient, easy to read, and lasts for the life of the installation. It has no liquids or working parts to get out of order.

You Can Profit Many Ways from the Dwyer VISI-FLOAT

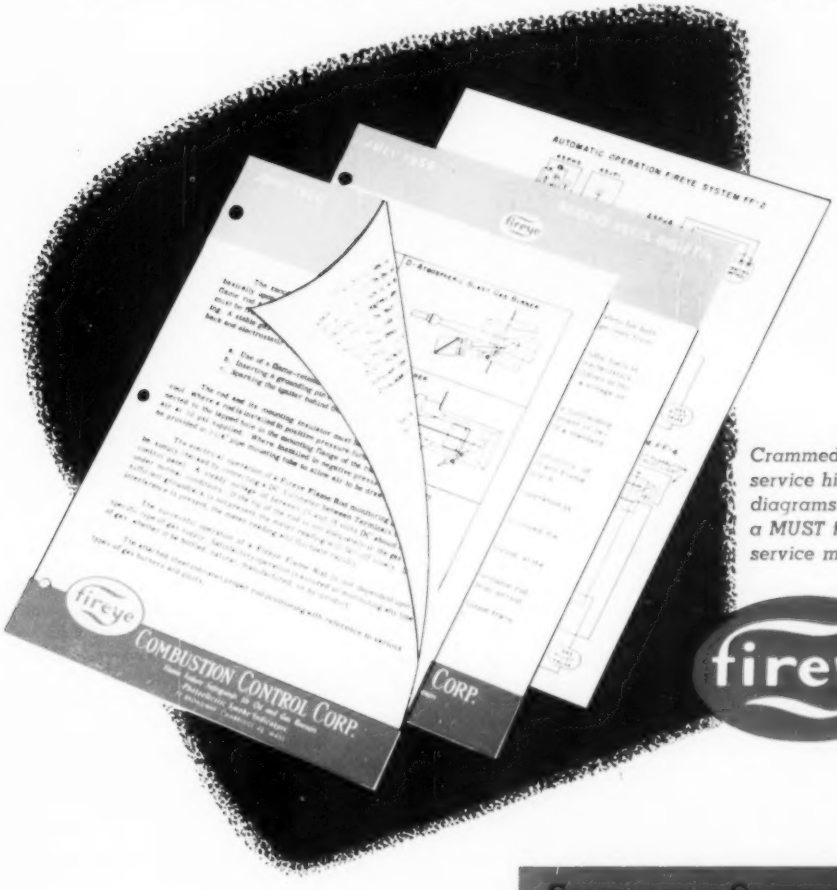
- VISI-FLOAT Sells More Filters for You.
- VISI-FLOAT increases customer satisfaction—it guarantees that, with a minimum of attention, the units you install will be filter-efficient at all times . . . . deliver more air, cleaner air—at less cost.
- VISI-FLOAT reduces unprofitable service calls—the owner now can check filter condition without your help.

Write Today for Bulletin No. 280 for Full Details

F. W. Dwyer Mfg. Co.

323 SOUTH WESTERN AVENUE CHICAGO 12, ILLINOIS

ARE THESE *New* BULLETINS IN YOUR SERVICE MANUAL?



Crammed with useful service hints and diagrams . . . these are a MUST for every service man.

fireye

If not . . . mail the coupon for your copies today, because . . . with Fireye sales up more than 400% over last year's spectacular record . . . you'll be installing more and more Fireye equipment every day from now on.

There's a reason for Fireye's unprecedented popularity: it's the most positive and foolproof flame-failure protection . . . and that's why it sells itself to engineers who specify, install and service oil and gas burners for modern industry.

Mail that coupon NOW.

COMBUSTION CONTROL CORP.
70 BROADWAY CAMBRIDGE 42 MASS.

Gentlemen:

Please send the following service bulletins:

- [x] Hints on Flame Rods
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- [ ] The Complete Fireye Story

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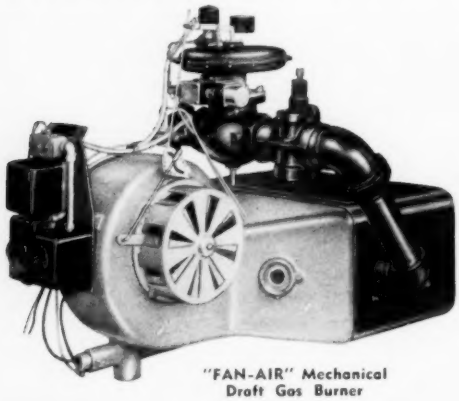
A distinguished

Pair of **AUTOMATIC**

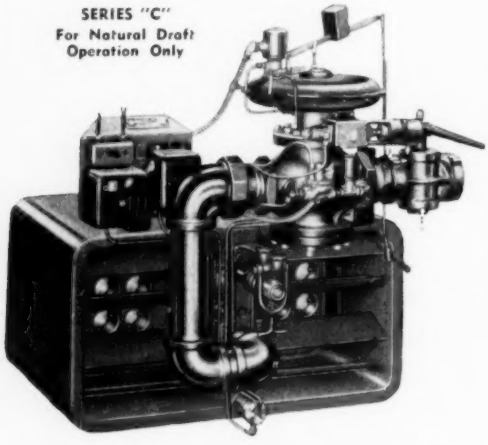
"PACKAGED GAS BURNERS"



"FAN-AIR" Mechanical Draft Gas Burner

BOTH NEW (1950 Model) FAN-AIR & Type "C" Burners pictured here represent the most modern & advanced fully automatic assemblies. NOT JUST gas burners BUT complete BURNER SYSTEMS, factory tested & ready for application, when received. Each embody dependable spark ignited rectifier safety pilots with Flame Safeguards, 100% shutoff plus throttling & On-Off fuel controls. Why be satisfied with less when all these tangible advantages are so readily available. Meets Underwriter Requirements.

SERIES "C"
For Natural Draft Operation Only



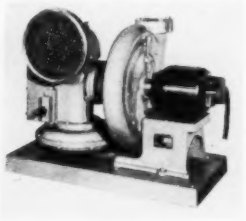
LEE B. METTLER CO.

NOTE THIS NEW ADDRESS

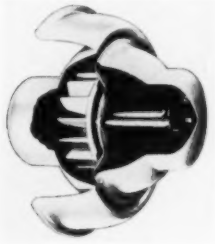
4366 WORTH STREET LOS ANGELES 63, CAL.

ments, or atmosphere gas generating requirements, in the single valve, by air-gas regulation for the particular requirements.

Suitable for use with manufactured, natural, or liquefied petroleum gases, the valve is designed to provide a predetermined proportion. A turbo compressor is used to maintain the desired discharge pressure, and according to the company, the mixture ratio is independent of fluctuations in gas pressure or changes in output demand.



Air-Gas Mixing Valve



Exhauster

HPAC 24—EXHAUSTERS—A new line of explosionproof wall exhausters is being offered by Jenn Air Products Co., 338 N. Pennsylvania St., Indianapolis.

These units are said to be unique in that they are flanged directly to the outside wall. As shown in the illustration, the motor is mounted outside the air stream, with the entire unit on the building exterior. The housing is constructed of aluminum and the nonferrous centrifugal blower is directly connected to the ball bearing explosionproof motor. Similar units especially adapted for roof application are also available.

HPAC 25—HIGH PRESSURE FLUID ACCUMULATORS—Low pressure, air operated accumulators designed to eliminate the danger of handling high pressure gases and to store fluids at pressures up to 10,000 psi for use when required are now being offered by Miller Motor Co., 4027 N. Kedzie Ave., Chicago 18.

Ordinary plant air at 60 to 200 psi is used as the compressible medium. In pump circuits, oil flows from the pump into the accumulator during the nondemand pump cycle. The oil, under the high pump pressure, works against a hydraulic piston driving a larger air piston which, in turn, works against the low pressure compressible medium. The oil is thus "stored" in pressures up to 10,000 psi for either immediate or later discharge.

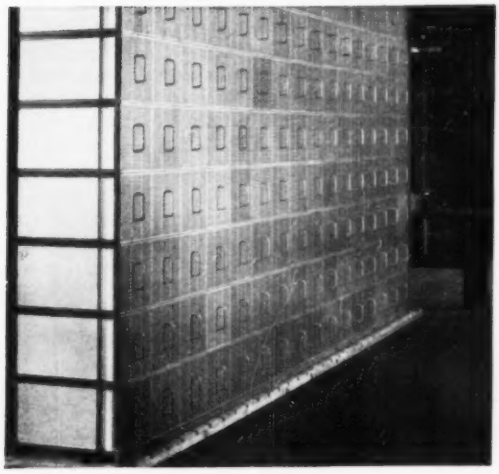
HPAC 26—INDUSTRIAL AIR HEATER—A portable industrial air heater is now available from National Heater Co., 2182 Cleora Ave., St. Paul 4, Minn.

Offered in five sizes with capacities from 300,000 to 1,800,000 Btu per hr, it is a completely packaged oil burning unit with a built-in storage tank and is equipped with casters to facilitate moving from place to place. The combustion chamber and firebox are of stainless steel and an induced draft blower is used.

According to the company, the heater is ideal as a tem-

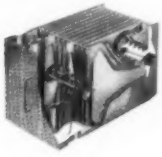
Advanced design makes Electromaze electric air filters...

1) Easiest to install!



Electromaze, a new kind of electrostatic precipitator, is made up of individual cells that slide in and out like filing cabinet drawers. Electromaze Uni-Cell "file drawer" cells are available in three sizes and can be combined to meet almost any space or capacity requirement. The cellular steel holding frame is prefabricated, saving installation time and labor.

Electromaze cells have dual ionizing wires, providing complete charging of air-borne particles of dust, pollen and smoke. All-aluminum plate construction resists corrosion and reduces weight. A self-adjusting power supply maintains optimum filtering, assures protection against even a complete short circuit.



Cutaway shows construction of Electromaze Uni-Cell

2) Easiest to clean!

Field tests have proved that with normal industrial city dirt, each 12" Electromaze cell holds up to 300 grams of dirt before cleaning is necessary. Due to the extra wide collector plate spacing in Electromaze cells, the filter can be quickly and easily cleaned in place with a pressure hose. If manual cleaning does become necessary—as it may in all types of electrostatic filters—the cells can be readily removed for cleaning.

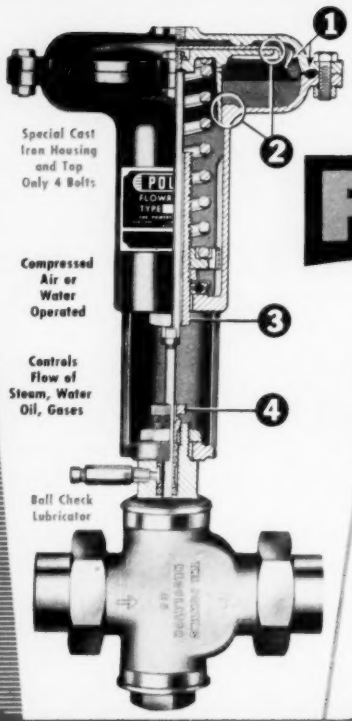
From one end of the United States to the other, Electromaze filters are already proving their worth in hospitals, bowling alleys, factories, stores, offices,—and in dozens of other applications where super-clean air is desirable. For further information, contact your nearby Air-Maze representative or write the Air-Maze Corporation, 5200 Harvard Avenue, Cleveland 5, Ohio.

AIR FILTERS
SILENCERS
SPARK ARRESTERS

AIR-MAZE

THE FILTER ENGINEERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS



POWERS **FLOWRITE** VALVE

VALVE TOP—Durable moulded neoprene diaphragm (1) has positive sealing bead which provides increased sealing action with increasing control pressure. Efficient diaphragm form insures ample and constant operating power thru full travel. Piston Plate Assembly (2) has a free floating thrust plate which absorbs side thrust. Closely guided piston plate maintains stem in accurate alignment.

3 **ADJUSTING SCREW**—Ball bearing non-rising type. Easily accessible, 180° turning radius with starting pressure adjustable from 0 to 17 psi. Has enclosed rust proofed steel spring for full travel in 5 or 10 psi. control pressure change.

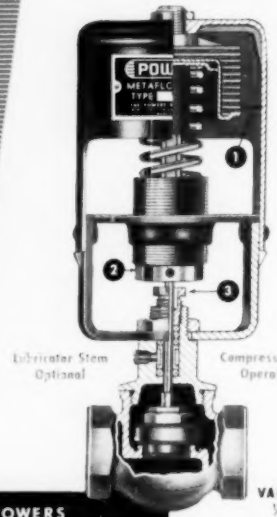
4 **BONNET ASSEMBLY**—Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

VARIETY of VALVE BODIES — Sizes ½" thru 8" — For line pressures below 250 psi. Rugged construction to withstand piping strains. Single seat or double seat, bronze and stainless steel trim. Double unions and flanged ends. Available normally open (direct acting) or normally closed (reverse acting) and 3-way type valves.

POWERS

Get TOP Performance WITH THESE BETTER Valve Tops AND Reduce Maintenance

Packless Valves Available



POWERS *Metaflow Valves* are small, sturdy, light-weight, reasonably priced, suitable for many control applications where the pressure differential does not exceed 75 lbs. per square inch.

1. **HOUSING**—High strength aluminum alloy. Hydraulically formed long life brass bellows provides smooth and powerful stroke.

2. **ADJUSTING SCREW**—Brass with rust proofed steel spring having 15 lbs. adjustment range to give proper sequence operation where required.

3. **BONNET ASSEMBLY**—Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

TRIM—Composition disc with brass integral seat and self-aligning disc holder. Available normally open (direct acting) or normally closed (reverse acting), and 3-way.

METAFLOW NO-PAK VALVES prevent leakage of inflammable or harmful liquids or gases and provide vacuum protection. Are suitable for use with Freon, oil, gasoline, non-corrosive gases, hot or cold water and low pressure steam.

Phone or Write Nearest Office for Prices

POWERS **METAFLOW** VALVE

VALVE SIZES— ½" thru 2"

Bronze bodies, screwed ends. Rugged construction to withstand piping strains.

THE POWERS REGULATOR CO.

OFFICES IN OVER 50 CITIES • See Your Phone Book

CHICAGO 14, ILL., 2720 Greenview Ave. • **NEW YORK 17, N.Y.**, 231 E. 46th St.
LOS ANGELES 5, CAL., 1808 West 8th St. • **TORONTO, ONT.**, 195 Spadina Ave.
MEXICO, D. F., Edificio "La Nacional" 601

OVER 58 YEARS OF PNEUMATIC TEMPERATURE CONTROL

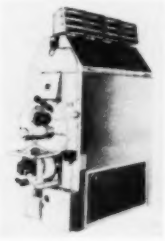
(FM3)

porary, emergency, or standby unit and is well suited for permanent installations in warehouses, garages, industrial plants, etc.

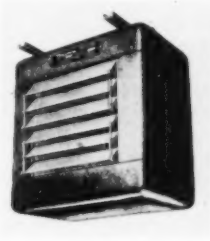
HPAC 27—AIR HEATERS—The new series 50 industrial type warm air heaters of Arthur A. Olson & Co., Canfield, Ohio, are designed for heating and ventilating industrial and commercial buildings, and they can also be used for process work and for make-up air applications.

The new line incorporates improvements on the control panels, induced draft fans and external designs. Features are said to include large areas of heat transfer surfaces with long four-pass gas travel, resulting in unusually low stack temperatures and high efficiency. Bearings are mounted on the outside of heaters to provide easy maintenance and accessibility. The use of a separate induced draft fan is said to be an outstanding feature.

The line includes units designed for use with gas, oil, or coal stokers, and capacities are from 300,000 to 6,000,000 Btu per hr.



Air Heater



Unit Heater

HPAC 28—UNIT HEATER—Now available from Brown Products Co., Forest Hills, N. Y., is the new "Brown Heet" horizontal, suspended type unit heater.

Said to combine modern styling with selective fan sizes, heaters are available in popular sizes and feature heat transfer surfaces constructed of $\frac{5}{8}$ in. diameter copper tubes mechanically expanded into aluminum fins.

HPAC 29—ROOF VENTILATOR—DeBothezat Fans Div., American Machine and Metals, Inc., East Moline, Ill., is now producing a new style vertical discharge roof ventilator for industrial applications. This motor driven unit is designed for exhausting air from foundries, machine shops and other buildings where harmful exhaust fumes must be discharged into the air as high as possible above the roof.

Units are available with fan wheels 36, 42, and 48 in. in diameter and in capacities up to 40,900 cfm. The fans are of weatherproof design.

HPAC 30—HOSPITAL THERMOSTAT—A new hospital thermostat that can be read and adjusted in total darkness has been developed by Minneapolis-Honeywell Regulator Co., 2604 Fourth Ave., S., Minneapolis 8.

The temperature setting and thermometer scales on the new device are painted with radium so that numerals and indicators are visible without other light. In addition, special plastic magnifiers are mounted in both scale

because it does man-sized jobs

A mighty midget is this Ward Leonard 105 Relay!

It's frequently used on jobs normally requiring heavier-duty relays. Certain types are Underwriters-approved as motor controls.

Unique spring suspension adds a self-cleaning action to the oversize silver-to-silver contacts. Note how the posts are securely anchored in the base—another typical Ward Leonard feature.

Write for Bulletin 105. WARD LEONARD ELECTRIC CO., 24 South Street, Mt. Vernon, N. Y. Offices in principal cities of U. S. and Canada.

WARD LEONARD ELECTRIC COMPANY
Result-Engineered Controls
RESISTORS · RHEOSTATS · RELAYS · CONTROL DEVICES

Because they're years ahead in steam generation ...

only

CYCLOTHERM
STEAM
GENERATORS

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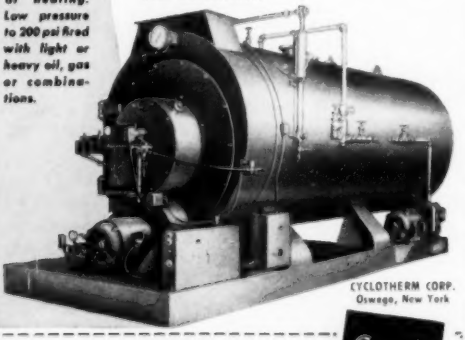
HAVE the REAL
ANSWER TO
Low GAS and OIL
CONSUMPTION

WHAT IS IT? It's the modern scientific discovery of transferring heat at the highest degree of efficiency with a new low in fuel consumption. Principal factors of which are the cylinderized solid flame with its exclusive cyclo-motion power, designed to utilize the full potential of every particle of fuel . . . and the thin layer of air resulting from centrifugal force that's always between the flame and wall of combustion chamber. A combination to produce steam far in excess of conventional standards for measured heating surfaces.

SEND FOR ALL THE BIG REASONS

Learn how the completely automatic Cyclotherm with its unexcelled all-in-one package type features wipe out waste and excess costs. If you are planning a new or replacement boiler installation it will pay you to first get the facts on Cyclotherm. The coupon below is for your convenience.

SIZES available to fit your steam or water load for processing or heating. Low pressure to 200 psi fired with light or heavy oil, gas or combinations.



CYCLOTHERM CORP.
Oswego, New York

CYCLOTHERM CORP., OSWEGO, N. Y.

Gentlemen: Please send me bulletin H-1 showing the advantages of Cyclotherm's new concept in Heat Transfer. Without obligation, of course.

Dept. HP-9

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openings to improve their legibility and avoid errors in setting. According to the company, the new thermostats will keep disturbances to patients at a minimum and will enable nurses and attendants to read and adjust room temperatures quickly and easily.

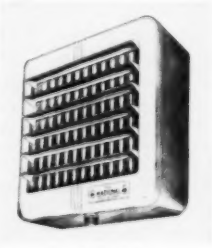
The adjustment knob is designed to discourage tampering by patients and visitors and a lock type adjustment is available.

HPAC 31—UNIT HEATERS—Horizontal and downflow vertical type unit heaters for either steam or hot water systems are now being marketed by National Radiator Co., Johnstown, Pa. The line consists of 24 different sizes of horizontal units and 16 different sizes of vertical units and is designed for commercial, industrial, institutional and public building applications.

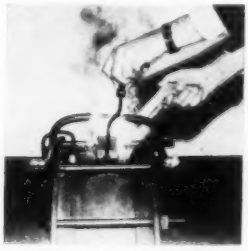
At 2 psi steam pressure and 60 F entering air temperature, the new models are rated from 25,900 to 360,000 Btu per hr for horizontal sizes. The vertical units are rated from 32,600 to 500,000 Btu per hr. Also offered are 14 units especially designed to deliver air at low temperatures when used with high temperature steam.

Standard and heavy duty cores are available, both fabricated from seamless copper tubing. Rippled aluminum fins are bonded by hydraulic expansion of the copper tubes. Fans are of the propeller type and motors are made specifically for fan duty.

In both horizontal and down flow units, the fan shroud is an integral part of the steel cabinet which is said to be designed so as to assure maximum fan performance and quiet operation. The company reports the availability of different diffusers for the vertical models and motors of different characteristics for all models. The company is also marketing all necessary controls.



Unit Heater



Bonding Pipe Couplings

HPAC 32—BONDING COUPLINGS ON PIPE LINES—Dresser Mfg. Div., Dresser Industries, Inc., Bradford, Pa., has introduced a new "Dresser-Bond" kit designed to simplify the bonding of mechanical couplings on steel pipe lines.

The kit, consisting of 50 preformed bonds, welders, flint gun, flash powder, metal discs, and coating compound for completing 50 bonds, employs a chemical welding process which, the company says, any workman can use.

The resistance of the bond is said to be low and to retain its superior bonding properties permanently because a homogeneous weld area is attained and because all surface control variables are eliminated. According to the manufacturer, there is no danger of burning the copper wire, pipe or inside pipe coating.

JUST PUSH THE BUTTON

to put these powerful forces to work in your company

Right now management has an unusual opportunity to gain employee-relations value from the high public interest these genii have created for U. S. Savings Bonds. During the Treasury Department's Independence Drive, May 15-July 4, every major advertising medium has been used to broaden the people's interest in Savings Bonds as a means of building financial independence. Now, more than ever, as a result of this all-out campaign, your employees will appreciate the convenience of being able to obtain Bonds "automatically" via the Payroll Savings Plan.

If your company doesn't yet have the Payroll Savings Plan, now's the most opportune time for you to install it!

If your company does have the Plan, now's the time to remind employees about it!

Employees who pile up money in Savings Bonds feel more secure . . . are actually better workers. Moreover, Bond sales build a backlog of future purchasing power—good "business insurance" for all of us in the years ahead.

Payroll Savings is good for your employees, your business, and your country. "Push the button"—call in one of your top executives and appoint him Savings Bonds Officer. All the material and assistance he may need are available from your State Director, Savings Bonds Division, U. S. Treasury Department.

The Treasury Department acknowledges with appreciation the publication of this message by

HEATING, PIPING & AIR CONDITIONING

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ELCO
Screws

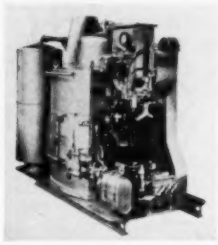
Yes, you're in luck because ELCO Screws are GOOD screws. We take extra pains at every step, from the selection of material to final inspection, to see that ELCO products are second to none in quality and uniformity. And we think *we* are in luck, too — to have such a large group of satisfied customers.

SPECIALS

SHOWN HERE: JUST A FEW OF THE HUNDREDS OF "SPECIAL" PIECES WE ARE MAKING

ELCO TOOL & SCREW CORPORATION
1920 BROADWAY • ROCKFORD, ILLINOIS

HPAC 33—STEAM GENERATOR—The new model 4635 steam generator of Vapor Heating Corp., 80 E Jackson Blvd., Chicago 4, has been designed to supply large quantities of high pressure steam for short or sustained periods. It is said to develop 200 psi working steam pressure in 2 min from cold water and to make over 3500 lb of steam per hr at 75 to 300 psi. This, says the company, is accomplished by passing hot gases over a patented 575 ft steel coil.



New features are said to include the addition of an economizer coil placed in the path of exhaust gases, relocation of the motor to shorten the unit, the use of a hotter ignition spark, a smaller and heavier mounting plate, a larger combustion space, and increasing working steam pressure of the steam reservoir.

Once started, automatic controls take over causing the machine to turn off when the predetermined steam pressure is reached, then on again when the pressure drops 15 psi. One 5 hp electric motor or gas engine is used.

HPAC 34—PIPE NIPPLE CHUCK—A new nipple chuck for the threading of short nipples is now available from Ridge Tool Co., Elyria, Ohio. It is designed to fit any threading machine or vise without special tools, parts or adjustments. According to the manufacturer, it requires no adjusting or changing of the stop plug which is an integral part of the chuck.

Nipples to be threaded are screwed in by hand, and after threading, released by a quick turn of the chuck, so they can be unscrewed by hand. Pipe adapters are made for ¼, ⅜, ½, ¾, 1, 1¼ and 1½ in. pipe. The nipple chuck itself holds 2 in. pipe. An adapter for ⅛ in. pipe is also available.

WE HEAR THAT . . . .

W. B. Connor Engineering Corp. has removed its main offices, plant and laboratories from New York to Danbury, Conn.

The first new plant unit, a single story structure of 40,000 sq ft, has been designed for assembly line production and includes a research area for work in air purification, air distribution and diffusion. Construction will begin shortly on a greenhouse and cold storage plant for specialized atmospheric control experiments.

Facilities planned include equipment for the evaluation of odor removal techniques covering wide variations of air temperature, odor concentration, humidity, air flow, etc., together with apparatus for the investigation of sense of smell and the physical and chemical properties of solid surfaces effecting the retention or removal of odors.

A separate laboratory, devoted to air distribution and diffusion, will have several duct networks capable of handling 7500 cfm at pressures up to 10 in. Emphasis will be placed on the study of high velocity systems.

The company is retaining an office at 114 E. 32nd St., New York City.

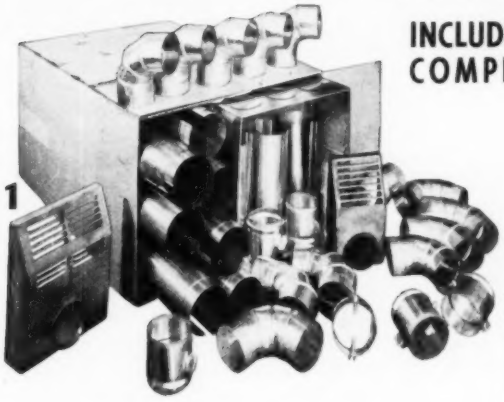
NOW 2 COMPLETE PACKAGE UNITS

to simplify SALES for you!

INCLUDING ALL NECESSARY MATERIAL FOR COMPLETE INSTALLATION IN EITHER

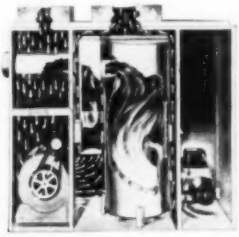
Oil or Gas Fired WARM AIR or HOT WATER HEAT

1



"TempRD" Air

Another General Automatic complete installation package! Here's your answer for quick and easy, *profitable* warm air installations. Easy to handle, store, sell and install! An installation job that requires no fabrication of materials. *Perfect for small homes.* System complete with warm air conditioners (for basement or basementless homes). Write for dull details. "TempRD" Air includes a complete duct system—plenum chamber for both supply and return; necessary 4" round duct, elbows, and registers.



With G/A OIL or GAS FIRED

WINTER WARM AIR CONDITIONERS

- *EASY, ECONOMICAL INSTALLATION*
- *TIME, LABOR, AND STORAGE SAVING*
- *EASY TO SELL*
- *MORE PROFITABLE*

2

"Floorlevel"

HOT WATER BASEBOARD

G/A's famous "Floorlevel" is the *modern way* to install hot water heating in any size home. *All in one package.* Saves you time, labor and storage. Includes metal baseboard, deairator tank, circulator, floor control valve and boiler-burner unit . . . *at real savings* . . . Check General Automatic . . . first with the finest.

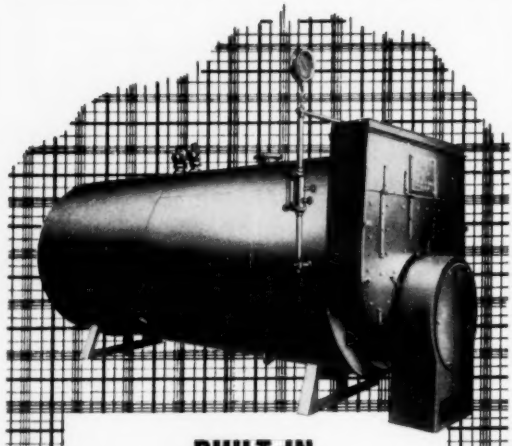
With G/A OIL or GAS FIRED BOILER BURNER UNITS for any size home

Since 1923

GENERAL Automatic

General Automatic Products Corp., 2300 Sinclair Lane, Baltimore 13, Md.

TITUSVILLE
SCOTCH MARINE
all welded
HEATING BOILER



BUILT IN
19 STANDARD SIZES
for Oil, Gas and Coal Firing

- Greater Heating Surface
- 30% More Disengaging Area
- For all types or combinations of fuel

TITUSVILLE builds a complete line of ALL types of power and heating boilers—in all sizes and ratings. The All Welded Scotch Marine *Wet Back Top* Heating Boilers are an excellent example of using *age-old* principles with all the new modern design and welding developments. Get the complete information on TITUSVILLE BOILERS —dependable since 1860.

Write for this Bulletin!

TITUSVILLE IRON WORKS CO TITUSVILLE, PA.
division of Struthers Wells

THE TITUSVILLE IRON WORKS CO.
TITUSVILLE, PENNA.
Representatives in Principal Cities

Babcock & Wilcox Tube Co., Beaver Falls, Pa., recently placed in operation a new mill for the production of electric resistance welded tubing at the company's Alliance, Ohio, plant. The new mill is the third such unit for the Welded Tube Division at Alliance. . . . . Sales last May of **United States Air Conditioning Corp.**, Minneapolis, were 43 percent over those for the comparable period of 1949. According to a recent report, the backlog of unfilled orders as of May 30, was substantially higher than at any previous time this year.

Sheet metal operations at **National Radiator Co.**, Johnstown, Pa., require additional space and a new $1 million plant is to be built in the greater Altoona, Pa., industrial area. It is expected that the plant will be in operation the first of the year and will permit streamlining of production facilities and will make room for new products in the Johnstown plants.

A number of expansions planned by **Kaiser Aluminum & Chemical Corp.**, Oakland, Calif., will add up to: 30 percent increase in aluminum reduction capacity (a boost of more than 80 million lb per yr in aluminum pig); an increase in finishing capacity by more than 72 million lb per yr at the Trentwood rolling mill, Spokane, Wash.; a step-up of production at the bauxite refining plant at Baton Rouge, La.; and an array of new products which are now set up for manufacture at the aluminum rod, bar, wire and cable mill at Newark, Ohio.

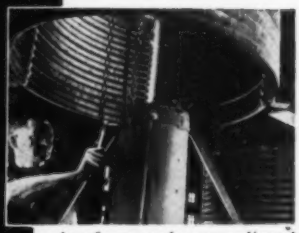
Reflecting the increasing recognition of air pollution as a national problem, the **Air Pollution and Smoke Prevention Association of America** is laying the groundwork for expanded activities. Formed late last year at the annual meeting of the former **Smoke Prevention Association of America**, the organization has launched a drive for increased support among interested individuals and industries. Activities will be governed by a board of directors of 16 members, currently headed by **Charles W. Gruber**, chief of smoke inspection, Cincinnati, who is president of the association. Pending the appointment of a permanent executive secretary, **Battelle Memorial Institute** has agreed to act as a headquarters unit for the association, with **Dr. Hamnett P. Munger**, in charge of Battelle's air pollution research, as executive assistant.

A recently announced $500,000 improvement program at the plant of **Fretz-Moon Tube Co., Inc.**, Butler, Pa., will include an increase in the size of the main mill building and the addition of new production facilities. The improvement program will result in a complete rearrangement of existing facilities and the company estimates that the changes will result in a 25 percent increase in output.

Rittling Corp. has consolidated its manufacturing operations and engineering department in a new location in Hamburg, N. Y., suburb of Buffalo. At the same time, new sales offices were opened in downtown Buffalo. The purchase of a two story Hamburg factory is part of a large expansion program designed to more than double previous production. The address of the new factory and engineering department is Pleasant Ave., Hamburg, N. Y. Executive and sales offices are at 1202 Rand Bldg., Buffalo.

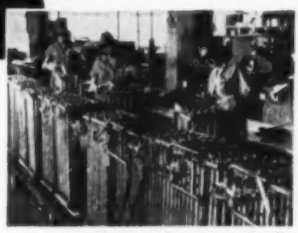
Take advantage of this

UNEQUALED EXPERIENCE
UNEQUALED PRODUCTION



Aerofin manufactures finned heat-transfer surface exclusively. The experience gained by such specialization permits the selection of just the right surface and materials for each particular job — for each application.

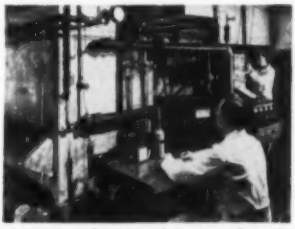
When you specify Aerofin finned heat-transfer surface, you specify high efficiency, long life and easy maintenance. As pioneer in the field, Aerofin has developed unequaled know-how and production facilities to apply to your particular heat-transfer application. Continual research accounts for the accuracy of Aerofin's published ratings. You can use them with full confidence.



Attention to the many details that make up the completed unit typifies the Aerofin way. For instance, in this particular coil, careful brazing of the return tubes to the header plates assures leak-proof construction.

Throughout the Air Conditioning Industry—

Aerofin units do the job Better, Faster, Cheaper



Aerofin controls every phase in the production of its finned heat-transfer coils and units. This control is maintained by rigid specifications and inspection, and all assembly is done in the Aerofin plant.

AEROFIN CORPORATION

410 South Geddes St. SYRACUSE 1, N. Y.

NEW YORK • CHICAGO • CLEVELAND • DETROIT • PHILADELPHIA • DALLAS • SAN FRANCISCO • MONTREAL

Superintendent reports "wonderful success" with ILG Unit Heaters

1 15% fuel saving
2 No repair costs in 15 years
3 No "cold spots"
4 Comfort for workers in coldest weather . . . beneficial effect on health, morale, efficiency

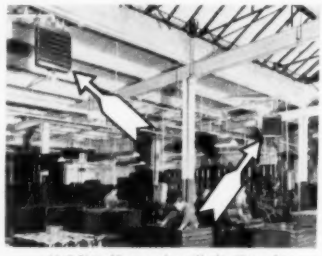
George Tintera, plant superintendent for Templeton, Kenly & Co., Chicago.

George Tintera, plant superintendent for Templeton, Kenly & Co., Chicago, reports "a clear saving of 15% in fuel bills" by using ILG Unit Heaters. In 1935 the factory heating system was modernized with 13 ILG Unit Heaters replacing pipe coils. Later 10 more ILG Heaters were installed as changes were made in the plant. Tintera's records show, "We have not had to spend a single dollar for repairs, and maintenance has been confined to periodic lubrication of the motors."

No "Cold Spots"

Tintera's report further testifies, "The entire plant is now evenly heated so that no floor space is lost in 'cold spots' during the winter months.

"Our men work in comfort during the coldest weather. This has a decided beneficial effect on their health, morale, as well as their production efficiency." In conclusion, he states, "We regard the change-over made from pipe coils to ILG Unit Heaters thoroughly worth-while from every angle."



ILG Unit Heaters Installed in Templeton, Kenly & Co. Plant in Chicago.

New literature showing all types of horizontal, vertical and low ceiling applications (as well as electric and gas fired) now is available for the asking. Phone your nearby Branch Office or send coupon today.

Send coupon for prices, data

ILG

STEAM, HOT WATER, GAS, ELECTRIC
UNIT HEATERS

ILG Electric Ventilating Co.
2841 North Crawford Avenue, Chicago 41, Illinois
Offices in more than 40 Principal Cities

☐ Please send FREE new Broadside describing ILG Unit Heaters

Name _____

Address _____ Zone _____

City _____ State _____

Carrier Corp., Syracuse, N. Y., is now publishing a new monthly house organ, Inside Carrier. Dedicated to the 4800 distributors and dealers of the firm, the new publication contains stories covering new markets, successful selling techniques, unusual applications, sales promotion angles and dealer personnel news.

A two-day sales convention was recently held by **Perfex Corp.**, Milwaukee. Field representatives in attendance visited the Milwaukee School of Engineering where the new weekly series of Perfex three-day schools is being held. . . . . Employees of **L. J. Mueller Furnace Co.**, Milwaukee, have been awarded a plaque for establishing an outstanding continuous safety record. The award was recently presented by the Wisconsin Council of Safety.

Baltimore Aircoil Co., Inc., Baltimore, Md., has appointed four new exclusive representatives. **Glenn Moore Comstock**, 321 Investment Bldg., Pittsburgh, is handling Pittsburgh, western Pennsylvania and the state of West Virginia. **Thermal Products Co.**, 4501 Prospect Ave., Cleveland, is covering Cleveland, Sandusky, Mansfield, Akron, Canton, and Youngstown, and **Emanuel Feinberg & Associates**, 6432 Cass Ave., Detroit, is handling representation in the southeastern part of Michigan and metropolitan Toledo. **Zintel, Byfield and Co., Inc.**, 1217 W. Washington Blvd., Chicago, is covering northern Illinois and northern Indiana.

C. H. Dutton Co., Kalamazoo, Mich., and **Hapman Conveyors, Inc.**, Detroit, have merged and formed **Hapman-Dutton Co.** The Dutton Boiler Division will have its principal sales office at 630 Gibson St., Kalamazoo 6, Mich., where the executive offices and all manufacturing operations will be centralized.

Refrigeration Engineering, Inc., Los Angeles, has announced the recent appointment of 10 new distributors. They are: **Abco Refrigeration Supply Co.**, New York City; **Air Conditioning & Refrigeration Co., Inc.**, Anchorage, Alaska; **Bowen Refrigeration Supplies, Inc.**, Atlanta; **Hajoca Corp.**, Philadelphia; **Mideke Supply Co.**, Oklahoma City; **Palmer Supply Co.**, Tulsa; **Refrigeration & Power Specialties Co.**, Seattle, Portland, Tacoma; **William W. Short Co.**, New York City; **Tesco Distributors**, Newark, N. J.; and **Wakefield Supply Co.**, Spokane.

Robert L. Gray, Bar Harbor, Me., recently became the 7000th student to attend the installation and service school conducted by **Williams Oil-O-Matic Div., Eureka Williams Corp.**, Bloomington, Ill. The school has been attended by oil heating equipment students from every state in the nation and many foreign countries in the last 28 years.

Eutectic Welding Alloys Corp., New York City, is sponsoring a $1000 prize competition for technical papers dealing with research and development in the field of "nonfusion" welding processes. The competition opens this month and closes May 31, 1951. Persons in both industrial and educational fields are eligible to compete and rules governing the competition may be secured from the company at 40 Worth St., New York 13.

. . . the BEST BUY for—

INCREASED ATTENTION and LASTING SALES POWER

THE JANUARY 1951 ISSUE

and 17th Annual Directory Number of

HEATING, PIPING & AIR CONDITIONING

DIRECTORY SECTION . . . .

Every product used in industrial and large building air conditioning, heating and piping will be listed. We'll tell who makes these products and their trade names. All advertisers as they appear in this Directory Section will be prominently identified indicating that more detailed information is elsewhere in the issue. It's the industry's best and most complete BUYING GUIDE—printed on colored stock in a special section.

SHOW SECTION . . . . . .

The January Number will preview the 10th International Heating, Ventilating, and Air Conditioning Exposition, Philadelphia, January 22 to 26. We will cover it completely . . . for those who attend, a "*where to go*" and "*what to see*" Guide—for those who can't go, the highlights of the show in print. Subscribers will get January HP & AC well in advance of the Show's opening date.

STANDARD EDITORIAL CONTENT . . . . . .

January HP & AC will be a "regular issue" in every respect. It will carry a full quota of timely articles, and the Journal Section of the American Society of Heating and Ventilating Engineers—the same as in every issue of this field-leading book. For extra attention value, it will have heavy covers, and be specially mailed.

Here's a regular issue, a directory issue, a show issue—all combined in one great January number . . . . and ***no advance*** over regular issue rates!

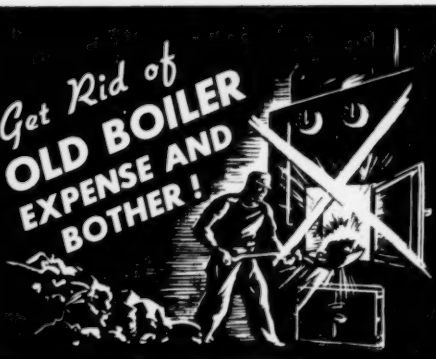
Here your advertising will get ***increased attention***, and have ***lasting sales power*** (as catalog reference copy) throughout all of 1951.

Here is the "best buy" of the year in our field . . . . the place where a convincing sales story of your complete facilities will do you untold good.

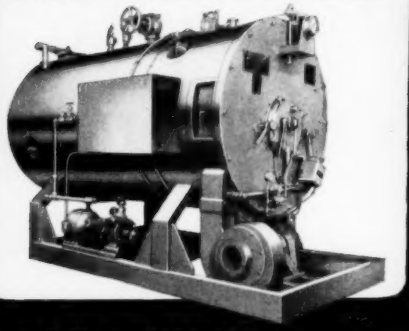
Here is where ***extra*** space for ***extra*** emphasis belongs!

Most advertisers use increased space with us in January—spreads, inserts, color. They catalog their entire lines. You, too, can profit most by doing a complete job. Make space reservation now . . . . we'll be glad to help with copy preparation if needed.

Heating, Piping & Air Conditioning
6 North Michigan Avenue
Chicago 2, Illinois



AMESTEAM GENERATOR
Supplies Abundant Steam
AUTOMATICALLY



✓ EASILY INSTALLED IN MINIMUM SPACE

✓ PAYS FOR ITSELF IN FUEL AND MAINTENANCE SAVINGS

✓ OIL, GAS OR OIL-GAS COMBINATIONS

Nineteen Sizes — 10 to 500 H. P.
15 to 200 lbs. Steam Pressure

Write Today for Free Bulletin

AMES IRON WORKS

BOX 2009 OSWEGO, N. Y.

Builders of Better Boilers since 1848
Manufactured under
License in Canada by VOLCANO, Ltd., Montreal, P. Q.

Mundet Cork Corp. has completed a new plant for the manufacture of 85 percent magnesia insulation. Located on a 13 acre site adjoining the firm's cork processing plant in North Bergen, N. J., the new facilities are said to incorporate the most modern equipment and methods for the manufacture of 85 percent magnesia pipe covering and block insulation. The new plant will enable the company to produce both high and low temperature insulation.

A new salesmanship course in selling air conditioning is being started this month by **Detroit Air Conditioning Institute**, 4258 Woodward Ave., Detroit. According to George H. Clark, institute director, the purpose is to provide a training for salesmen in vital selling essentials to aid in the marketing of air conditioning, refrigeration and heating equipment. ..... **Babcock & Wilcox Tube Co.**, Beaver Falls, Pa., is now producing seamless hot finished tubing in outside diameters up to $9\frac{5}{8}$ in. and seamless cold drawn tubing up to $8\frac{7}{8}$ in. OD. The former maximum size was $8\frac{5}{8}$ in. OD.

A new quick action, machinist's vise, built on a new principle and embodying a patented fast slide action, has been developed by **Dodge Mfg. Corp.**, Mishawaka, Ind. Known as the "Slide-Set" vise, it is designed to open or close to any position in one second through a push-pull action which eliminates the spinning of the handle. It weighs 58 lb and is said to combine the ruggedness and full power of a conventional type vise with an instant slide action that speeds production, reduces fatigue and increases efficiency.

Army-Navy certification has been given the $\frac{3}{8}$ in. hydraulic precision relief valve of **Pantex Mfg. Corp.**, Pawtucket, R. I. This pressure valve had been certified previously for Army and Navy aircraft for $\frac{1}{2}$ in. tubing. It is a cartridge type relief valve with pressure settings from 100 to 5000 psi and is available for industrial use in housings ported for $\frac{3}{8}$ in., $\frac{1}{2}$ in., and $\frac{3}{4}$ in. pipe.

A new short-stroke solenoid for heavy duty industrial applications is now available from the control divisions of **General Electric Co.**, Schenectady 5, N. Y. It features a cast "Permafil" coil assembly and the basic component of the new device is a paper-layer-wound coil designed to hold the voltage between turns to a minimum and reduce the possibility of failure due to reduced voltage between layers of turns. Originally designed for high speed, pilot valve operation, the new solenoid is said to be ideal for any heavy duty industrial application requiring a push type solenoid with a maximum stroke not exceeding 5/16 in.

The advertising firm of **Edward Owen & Co.**, Avon, Conn., is now producing individualized parts and equipment catalogs for refrigeration and air conditioning wholesalers. Said to feature an unusually low price, catalog contents can be selected by wholesalers in 30 min from more than 300 "library" pages maintained by the firm—with changes or special pages made by a photographic process. A feature of these catalogs is a copyrighted price list which may be discarded when out of date and replaced with current lists by the publisher at cost and as a part of his service.

Badger expansion joints
help N. Y. Steam Corp. cut maintenance on about 75 miles of steam lines

When a Gothamite wants steam — unlike water — there's no shortage, New York Steam Corp. provides it instantly. From Battery to 92nd Street this gigantic system — the world's largest — at peak loads can serve over 10,000,000 pounds of steam per hour to about 3,000 Manhattan buildings. (See "The Heat's On in New York," Business Week, Jan. 14, '50)

Maintenance costs could easily get out of hand in such a vast underground system. Best protection? — The best equipment. And in Expansion Joints that means Badger. Since the early 1900's New York Steam Corp. has installed thousands of these famous joints — and maintenance costs have been kept to a minimum.

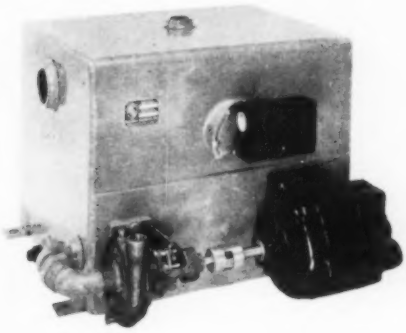
These construction features on Badger Joints can cut your costs too:

- **Directed-flexing rings . . . equalize stresses *between* and *within* corrugations**
- **Packless . . . pressure-tight single tube**
- **Compact . . . no larger than flanged fitting**
- **Special forming . . . no structure-weakening stresses**
- **Controlled heat treating . . . assures long life**
- **Fabricated from copper for normal pressures and temperatures, stainless steel or alloys to withstand high pressure, temperature and corrosion**

How about your expansion joint problems? Are you getting less than the best in performance? . . . In low cost operation? Then there's good news for you in the Badger story — write for details today.

Badger MANUFACTURING COMPANY
230 BENT ST. • CAMBRIDGE 41, MASS.

ANNOUNCING—
EAGAN "EAGLE"
CONDENSATE PUMP



MATCH THIS FOR VALUE!
Here's the best condensate pump "buy" on today's market. It provides far more capacity than any similar pump . . . 8,000 sq. ft. EDR at 20 PSI . . . and it's only **$119.00** (trade price).

Compare These Six Features

Mail coupon for full details

- √ **Low inlet, 2" IPS, 12" from floor**
- √ **All bronze centrifugal pump**
- √ **Flexible coupling**
- √ **Standard ¼ HP capacitor motor**
- √ **Thermal overload protection**
- √ **Level indicating 2 pole float switch**

WALTER H. EAGAN CO., INC.
Mfgs. of Condensate, Vacuum, Turbine, Boiler Feed and Centrifugal Pumps.
Pump Specialists since 1920

WALTER H. EAGAN CO., Inc. (Dept. B)
2336 Fairmount Avenue
Philadelphia 30, Pa.

SEND ME FREE DESCRIPTIVE BULLETIN OF THE NEW EAGAN "EAGLE" CONDENSATE PUMP

NAME .....

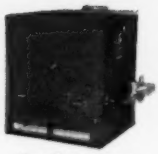
COMPANY .....

STREET .....

CITY ..... Zone .... State .....

A COMPLETE LINE OF...

GAS BOILERS



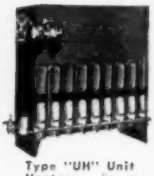
Type 20 Boiler — Forty one sizes, 315,000, 3,780,000 Btu input, in Btu increments of 63,-000 capacity.

Type 10 Boiler — Nine sizes, from 54,000 to 378,000 Btu input, in increments of 27,-000 Btu.

Type 11 Boiler — Same as Type 10 except that controls are not enclosed in outer cabinet.

...PLUS

UNIT HEATERS



Type "UH" Unit Heater — Space heating unit for factories, warehouses, hangers, shops. Nine sizes, 180,000-540,000 Btu input, in increments of 45,-000 Btu.

Type 150 Unit Heater — Steel. Suspended type, 60,000, 90,000, 120,000 and 150,-000 Btu input.

GAS CONVERSION BURNER

Type 500 Conversion Burner — Four sizes, 125,-000, 175,000, 225,-000 and 275,000 Btu input. Easily adjusted for proper capacity.

Mueller Climatrol

—the profit line

Here's a line engineered to give you a competitive sales advantage on any job—domestic or commercial: A complete line of gas-fired boilers — sized to give you close-to-capacity bids on any job; plus compact, efficient unit-heaters, and the outstanding gas conversion burner on the market today. All compact, efficient, handsome, easy to install — and backed by Mueller's 93-year record of leadership. Write for details. *L. J. Mueller Furnace Company, 2129 West Oklahoma Avenue, Milwaukee 15, Wisconsin.*

93rd Anniversary

Mueller Climatrol

REG. U. S. PAT. OFF.

E-40

FOR GAS FOR OIL FOR COAL

Adelta Mfg. Co., 21st & Ellsworth Sts., Philadelphia 46, manufacturer of standardized ducts and fittings, has introduced a one piece, snap lock cleat. The main advantage of this device is said to be the fact that it is formed as a part of the fittings and is not crimped, riveted, punched or spot welded. Supplied on all four sides of the company's fittings, the cleats have a tapered leading edge for easier assembly and there is no need for tools or additional fastening devices such as S-clips or drive cleats.

The "Kool-Sleep" self contained window fan cooler is available with or without a coin operating mechanism from **Kool-Sleep, Inc.**, Cambridge, Ohio. Outside air is filtered, washed, and cooled as it is drawn through the sides and rear of the cooler. The capacity is 2600 cfm.

A new model of the "Zero-Max" transmission with reverse has been developed by **Revco, Inc.**, 405 Thorpe Bldg., Minneapolis. This new model 14R unit is designed to give infiinite speed variation from 0 to 425 rpm at 1750 rpm input speed, in both forward and reverse. It is said to have the same characteristics as the original model 14 variable speed torque converter recently introduced. In addition to its variable speed, the model 14R is said to be an efficient torque converter with a rating of 10 in. lb on the output shaft and is recommended for such uses as throttles, governors, directional controls, drum rotations, etc.

A new type of welding cable for both electrode and ground, "Linconductor" cable, combines new design features with new manufacturing methods to increase both cable life and cable flexibility. It is now available from **Lincoln Electric Co.**, Cleveland 1, Ohio. The outer covering is neoprene, with a paper separator of 2½ mil thickness between the outer cover and the copper stranding.

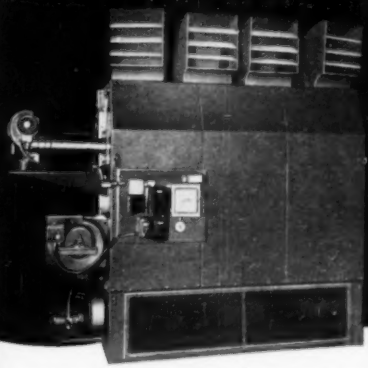
Gro-Quick Co., 340 W. Huron St., Chicago 10, has developed a thermostat primarily to control soil heating cables and electric heaters in greenhouses, etc. A plug-in attachment and plug-in receptacle for the load are used, and a charged bulb is connected by 3 ft of tinned capillary tubing to a bellows which actuates a microswitch rated at 15 amp, 115 or 230 volts. The switch and bellows mechanism, together with the double plug-in receptacle and a neon pilot bulb with a red bezel, are housed in a conduit box. The adjustable temperature range is from 46 to 85 F and the differential is 2 deg.

Vaco Products Co., 317 E. Ontario St., Chicago 11, is offering an "Amberyl" flashlight screw driver unit. The handle of the screw driver contains a flashlight bulb, battery, and directional plastic lens designed to throw a circle of light on the screw. The flashlight is operated by turning a knurled knob in the handle dome.

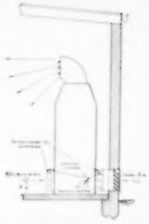
Of all-metal construction and weighing 30 lb, the new "Filter Breez" of **Lau Blower Co.**, Dayton 7, Ohio, incorporates a standard replaceable air filter and two centrifugal blowers, one mounted on each side of a motor. Designed for use in any window, the flow of air from the unit may be directed up, down, or to either side.

AIRTHERM

THE EASY-TO-INSTALL, COMPLETE HEATING AND VENTILATING SYSTEM IN ONE COMPACT UNIT



Airtherm Direct Fired Heater installed for heating as well as ventilating. Fresh air inlet connection and interconnected dampers control flow of recirculated and fresh air. Designed to provide make-up air to balance vacuum effect resulting from exhaust systems. Ideal for summer ventilation.



OIL* OR GAS FIRED

The Airtherm Space Heater has been designed with extreme flexibility for heating as well as ventilating steel plants, foundries, all types of industrial buildings and warehouses. They are furnished complete with all operating and safety controls for automatic operation. Airtherm Space Heaters have a heavy duty steel combustion chamber lined with castable refractory for simple maintenance and long life.

AVAILABLE IN 9 MODELS — oil* or gas fired — ranging from 650,000 to 2,000,000 Btu per hour output, in floor mounted or suspended types. For complete customer satisfaction, use Airtherm on your next job.

FOR DETAILED INFORMATION WRITE FOR CATALOG 802

*Approved by Underwriters' Laboratories

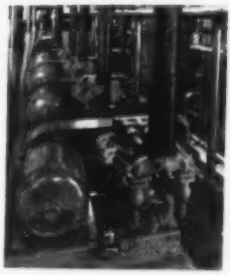
AIRTHERM MANUFACTURING COMPANY

711 South Spring Avenue — St. Louis 10, Missouri

7 50 TON SCHNACKE COMPRESSORS

Cool This Modern 6-Story Atlanta Office Building

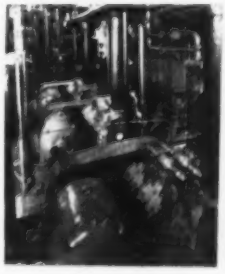
The 800 Peachtree Bldg., Atlanta installation assures constant comfort since it is designed with Seven Model E 50-ton Schnacke compressors and Four evaporative condensers, chillers, etc. with four complete systems, any of which can maintain comfort in case of mechanical failure. Seven compressors also provide flexible capacity and reduce operating cost. Schnacke compressors are recommended and used the world over by competent engineers in such installations.



These photos show the seven Schnacke 50-ton compressors installed in 800 Peachtree Building.

Schnacke Compressors Have Proven Their Superior Performance

On the job, where ability to take abuse is important, Schnacke compressors are proving their superiority to engineers who demand the highest quality. Schnacke production methods make possible lower prices yet provide modern compact design with refrigerant-cooled replaceable sleeves, force feed lubrication, automotive type replaceable bearings, balanced crankshaft, greater efficiency, and other improved features.



The Perpetually Renewable Compressor

Compressors and Condensing Units from 5 H.P. to 60 H.P.

OTHER SCHNACKE FEATURES. . . . .

THERMATROL . . . assures most efficient evaporator temperature control at lower cost.

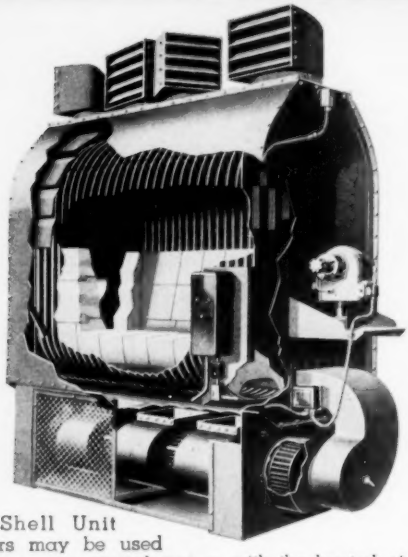
Also, SCHNACKE NEW UNLOADERS . . . for starting, plus progressive cylinder unloading for capacity control are completely self contained and set at the factory.

Write for complete Engineering Data.

SCHNACKE, INC.

1020 E. Columbia St., Evansville, Ind.

LEE SHELL UNIT HEATER



Lee Shell Unit Heaters may be used singly or as a central system with the heated air distributed through ducts.

The efficiency of Lee Counter-current flow reduces fuel consumption while the rugged simplicity of the system decreases cost of installation, assures low maintenance charges and provides ventilation without additional cost.

The LEE line . . .
Steel Encased Tubular Heater
Tubular Unit Heater
Brick-Set Tubular Heater
Shell Unit Heater
Write now for more information

LEE ENGINEERING CO.

95 RIVER ST. HOBOKEN, N. J.

Weighing 7½ lb, the new "Super-Slugger" electric hammer of **Noble & Stanton**, 1034 Broadway, Bedford, Ohio, is recommended for channeling in concrete, star drilling anchor holes for fixtures or entry holes through masonry for pipe or tubing, rapid cutting of sheet metal, and numerous other uses. A unique design principle is said to eliminate fatiguing "kick" and to eliminate direct vibration on the motor armature and other working parts. The manufacturer also supplies a line of hand forged tools for use with hammer.

To serve fractional horsepower, small space requirements, **Windfield H. Smith Corp.**, Springville, N. Y., is now producing a new double reduction speed reducer, designated type DBRA. It is designed for numerous duties in the transmission of small power loads and is stocked in 24 different right angle drive assemblies. The horsepower range is from 1/20 to 1/8, and reduction ratios are from 25:1 to 1764:1.

Pan-technics, Ltd., Encinitas, Calif., is offering the "Penscope" pocket telescope which is said to be suitable for checking meters, dials, gages, car numbers or stock piles while sitting at one's desk. The device is 5 in. long, weighs 2 oz, and provides six power magnification and a field of view of 315 ft at 1000 yds. . . . . The new, 5 oz packets of "Easy-Flo" 45, a silver alloy for brazing ferrous, nonferrous and dissimilar metals, developed by **Handy & Harman**, New York, has been added to the oxyacetylene welding line of the more than 800 authorized dealers of **Air Reduction Sales Co.**, a division of **Air Reduction Co., Inc.**, 60 E. 42nd St., New York 17.

A new line of low hydrogen electrodes is being produced by the welding division of **Harnischfeger Corp.**, 4400 W. National Ave., Milwaukee 14. The series includes 14 different types which are said to cover all welding applications where low hydrogen electrodes are desirable. The coatings, developed to produce deposits low in hydrogen, are said to eliminate under bead cracking.

Now available from **Chicago Wheel & Mfg. Co.**, 1101 W. Monroe St., Chicago 7, is a new electrically driven hand eraser. The manufacturer states that smooth, clean erasures without smudge on tracings and drafting room copies can be effected in a matter of seconds with the new unit which weighs 12 oz.

Electric Motor Corp., Div. of Howard Industries, Inc., Racine, Wis., is offering a new fractional horsepower motor, EMC model 1100. It is made with a die cast case and is a dynamically balanced single shaft motor of 1/20 hp for intermittent duty and 1/25 hp for continuous duty. It can be equipped with any EMC gear reduction unit or with an electric governor for constant speed.

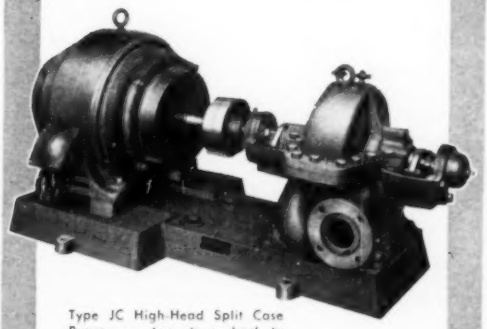
An oblong inspection mirror, offered by **Delavan Mfg. Co.**, Des Moines, Iowa, permits inspection through openings as small as 2 in. in diameter. Designed to withstand relatively high temperatures, it is of metal and has reflecting surfaces on both sides. The 20 in. handle is made in three sections for convenience in carrying and a cloth bag is furnished to protect reflective surfaces. Also available is a circular unit of 3-7/8 in. diameter.

Basic Design

makes WEINMAN your best buy in pumps

Unless your pumping installation incorporates the right basic design, you're pumping away money. The outstanding feature of WEINMAN Centrifugal pumps is the soundness of their basic design. WEINMAN engineered features make these pumps perform most efficiently . . . dependably . . . economically. The men responsible for these designs specialize in one product — Centrifugal pumps but their knowledge covers and benefits all industries, yours included.

You may be surprised to learn what the *right* basic design can do for your present pumping operations. A nearby WEINMAN representative can give you facts and figures. Contact him by mail, wire or phone TODAY!



Type JC High-Head Split Case Pump . . . two stage, back to back, impeller design . . . Capacity up to 600 G.P.M., Heads to 600 feet.

Representatives in Principal Cities

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

284 Spruce Street • Columbus 8 • Ohio

hot water *in a hurry!*

Where sudden hot water pulls—or an unpredictable time schedule—are in the order of things, install

Paracoil INSTANTANEOUS WATER HEATERS

TO KEEP PACE WITH THE LOAD—ALL THE WAY!

No storage tank is necessary—they have enough, and more, heating surface built into them to heat the water as fast as it is drawn! Thousands in use.

If you have such a problem, we have the answer! Stock designs permit quick deliveries..at prices lower than you think!

Write today for a copy of our new Bulletin 70 Section I, describing this line of Paracoil Water Heaters.

◀ This bulletin, in addition to tables of capacities and physical dimensions on our U-Tube designs, contains a wealth of practical, worthwhile engineering data on how to size, figure steam requirements, and pipe up PARACOIL INSTANTANEOUS WATER HEATERS. YOUR COPY AWAITS YOU!

DAVIS ENGINEERING CORPORATION

1064 East Grand Street, ELIZABETH 4, NEW JERSEY

30 Rockefeller Plaza, NEW YORK 20, NEW YORK

AGENTS IN PRINCIPAL CITIES

NOW New Streamlined RIDGID 65R

Die Stock that WON'T JAM

. . . while threading with power drive or by hand

New *JAM-PROOF* drive plate automatically kicks out driving ratchet pawl when standard length thread is cut. You don't have to watch it — lead screw can't jam on workholder.

Right Here is the simple foolproof mechanism that makes the 65R automatically Jam-Proof

You can convert your present 65R to new JAM-PROOF type — buy new drive plate, put in place of old plate.

All other RIDGID 65R features remain the same

Perfect threads on 1" to 2" pipe with 1 set of high-speed steel dies — sets to pipe size in 10 seconds — mistake-proof self-centering workholder sets instantly — and now it's *Jam-proof*.

Buy new JAM-PROOF 65R at your Supply House

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

WHO'S WHAT

Hamilton Merrill, a vice president and director of **Manning, Maxwell & Moore, Inc.**, Bridgeport, Conn., has been elected president of the company, succeeding **Robert Ross Wason**, who died last July. Mr. Merrill joined the firm in 1920 as assistant works manager and in May of this year was appointed vice president in charge of the Consolidated-Ashcroft-Hancock Division which is now headed by **Chester H. Butterfield**, vice president, who for the last 11 years has been in charge of sales of the division.

Frederick W. Smith, for the past six months vice president in charge of sales, has been named executive vice president of **Baker Refrigeration Corp.**, South Windham, Me. **Mark E. Mooney**, who resigned his position with Carrier Corp. and joined Baker last month, is now sales manager.

Foster Wheeler Corp., New York, has appointed **Pell W. Foster, Jr.**, vice president in charge of the newly created equipment division, which comprises the existing steam, industrial, marine and condenser departments. The new division has been set up to coordinate the activities of the present departments with the manufacturing and sales group. Mr. Foster, a director and vice president in charge of production since 1946, will continue as active head of the production and procurement departments.

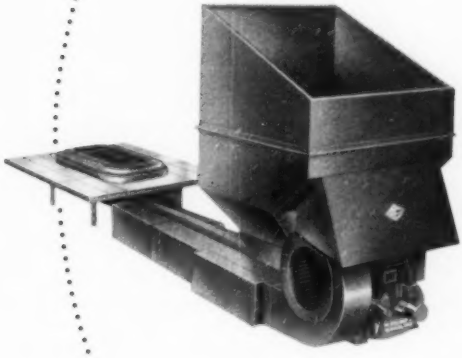
Gerald F. Twist is now a vice president of **Food Machinery and Chemical Corp.**, San Jose, Calif. He is manager of the company's **Peerless Pump Division**. . . . As the new assistant to the vice president of **Lincoln Electric Co.**, Cleveland, **A. W. Sawyer** will handle government bids and contracts and also conduct the company's educational activities. He had been in charge of development and production of welding instruction aids.

Grant A. Colton has served since 1934 as assistant manager of **Golden-Anderson Valve Specialty Co.**, Pittsburgh. He was recently elected vice president and general manager. . . . . **Richard W. Pentecost** is now general sales manager for **Baltimore Aircoil Co., Inc.**, Baltimore. For the past 16 years he has been associated with the Sturtevant Div., Westinghouse Electric Corp.

Carl Millsom has joined **Acme Industries, Inc.**, Jackson, Mich., as manager of the Flow-Cold Division. He formerly operated Temperature Equipment Corp., distributor for Chrysler Airtemp equipment and has also been associated with Fedders-Quigan Corp. From 1937 to 1940 he was sales manager and general manager, air conditioning, heating and refrigeration distributorships, Airtemp Div., Chrysler Corp.

William J. Millett, assistant to the vice president in charge of manufacturing, has been named works manager of the Holyoke works, **Worthington Pump and Machinery Corp.**, Harrison, N. J. He replaces **E. M. Detwiler**, resigned. . . . . All foreign sales of **United**

for **built-in** *Quality*



The WILL-BURT STOKER

Where quality is the primary consideration — where long, trouble-free service is more important than a "bargain-counter" original price — that's where you'll find a Will-Burt stoker on the job.

And there's a reason. Every part of every Will-Burt stoker is designed, engineered and produced for just one purpose — to provide dependable heat at low operating cost, and to provide it year after year. More than 50 years of manufacturing experience — more than 20 years of experience in the design and manufacture of bituminous coal stokers — stand behind every Will-Burt unit.

A complete range of sizes is available, with various types and models to suit the requirements of practically any installation. Capacities range from 20 to 600 pounds per hour. Consider Will-Burt for your next installation.

We'll rush specific information for any size or style upon your request.

ENGINEERS ARCHITECTS

Write now for a free reference manual covering Will-Burt stokers. It includes complete engineering data — sizes, capacities, dimensional drawings.

other **WILL-BURT** *heating products*

conversion oil and gas burners
domestic oil-fired hot-water heating boilers
coal, gas and oil-fired warm-air furnaces

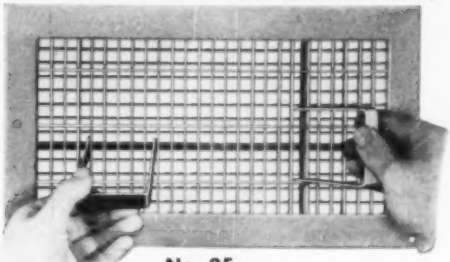
THE WILL-BURT COMPANY
DEPARTMENT H . . . ORRVILLE, OHIO

INDEPENDENT

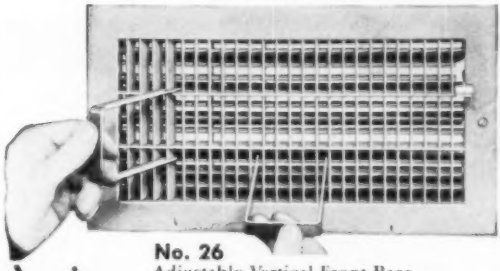
"Fabrikated"

DOUBLE CORE ADJUSTABLE BAR WALL GRILLES AND MULTIPLE VALVE REGISTERS

Each Grille Bar Adjusted Individually



No. 25
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars



No. 26
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars—with Horizontal Multiple Valves.

Depth with valves closed 1⅜"
Depth with valves open 2¼"

write for new catalog no. 50

MEMBER NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION — INDOOR COMFORT

Always Leading • Always Progressing

THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

States Air Conditioning Corp., Minneapolis, are being handled by **Consolidated Export Co.**, Minneapolis. Headed by **R. A. Villacres**, Consolidated Export represents many individual organizations for foreign sales. United States Air Conditioning's test laboratory is now headed by **Marvin M. Yarosh** who, for the last two years, did graduate work at the University of Minnesota.

T. S. Bonnema started with **Oster Mfg. Co.**, Cleveland, 28 years ago and since 1944 has been vice president in charge of production. He was recently elected a director of the company. . . . . Recent factory personnel appointments announced by **Johnson Service Co.**, Milwaukee, include: **John C. Spangler**, chief production engineer; **Earl J. Rice**, assistant factory superintendent in charge of manufacturing operations; and **Ralph F. Kubal**, assistant production manager for planning and scheduling operations. All are of Milwaukee.

James W. Bennett is now general sales manager of **Penn Industrial Instrument Corp.**, Philadelphia. For the past five years he has done special engineering sales work for Energy Control Co. . . . . **John E. Reed** is now sales manager of the Westfield branch, **H. B. Smith Co., Inc.**, Westfield, Mass., and **G. O. Allbee** is an executive sales consultant. Mr. Reed continues as secretary of the corporation.

Minneapolis-Honeywell Regulator Co., Minneapolis, has announced a number of promotions and additions. **Charles F. Woods** has been named valve division sales manager for the southwest region and will make his headquarters in Dallas. **Edward J. Byrne**, formerly with the Houston branch, has succeeded Mr. Woods as industrial manager in Dallas. **Howard W. Griesbach**, formerly in the Chicago office, is now industrial manager of the Milwaukee branch. Additions to the field sales staff include: **Louis C. Schultz** to Chicago and **William E. Van Horne** to Rochester, for industrial sales. **William J. Kirby** to Los Angeles and **P. R. Vogel** to Houston, for industrial supplies sales.

Transfers of **Minneapolis-Honeywell Regulator Co.** field men include: **Lawrence E. Kennedy**, transferred from Syracuse to Atlanta; **George Massey**, from Atlanta to Nashville; **A. R. King**, from Boston to Worcester, Mass.; **Gerald G. Walker**, from Detroit to Saginaw, Mich.; **W. J. Kilroy**, from Detroit to Grand Rapids; and **John Koerner**, from Pittsburgh to Youngstown, Ohio. In addition, **Carl Bohnlein** has been transferred from general to industrial sales at Philadelphia, and **George Jensen** has been transferred from Chicago industrial service to industrial sales at Menasha, Wis.

Eureka Williams Corp., Bloomington, Ill., has completed plans for the reorganization and expansion of its engineering department, which is now divided into two divisions, research and product development. Under the new plan, **H. E. Earl**, chief engineer of **Williams Oil-O-Matic Division** for the past 10 years, will fill the newly created post of director of research. **C. M. Pierson**, former staff engineer, becomes director of product development and **C. R. Wolter**, former liaison engineer between the vacuum cleaner and Williams Oil-O-Matic Divisions,

WEBSTER SERIES 14
GAS COMBUSTION CONTROL

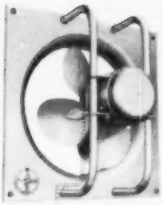
- Operates the BOILER UPTAKE DAMPER
- Uses only 10 CFH of air
- PRECISOR equipped
- Uses butterfly bodies with LOW PRESSURE DROP
- FLOW CHARACTERISTICS match the damper
- Can be furnished with INTEGRALLY MOUNTED MASTER PILOT
- Installed in the gas line as ONE COMPLETE UNIT
- NEW LOW PRICES—PROMPT DELIVERIES

For SERIES 14 CONTROL

Information Write—

THE WEBSTER ENGINEERING CO.

P. O. BOX 2168 TULSA, OKLAHOMA



Peerless Electric

TYPE PVS EXHAUST FANS

FEATURES

ALL-PEERLESS ELECTRIC UNITS—These fans are completely designed and manufactured by The Peerless Electric Company, a manufacturer of fans and motors since 1893. Both the motor and fan are designed to work together as a unit. This assures quiet operation and full rated output.

CAPACITOR MOTOR—Permanent split capacitor type using no internal switches or mechanical parts to fail and cause breakdowns. Totally enclosed to exclude all dirt and moisture drawn over the motor. Highest quality material available used on all parts for a trouble-free motor.

QUIET OPERATION—Wide heavy gauge steel blades rotating at slow speed to assure rated capacity at low noise level.

HORIZONTAL OR VERTICAL MOUNTING—Fans may be mounted in either position. Ball bearing in rear hood to take end thrust in all positions. Easy to lubricate and service.

FURNISHED COMPLETE—Controller for single speed, two-speed, or three-speed furnished with unit as ordered. No other switches or starting equipment required.

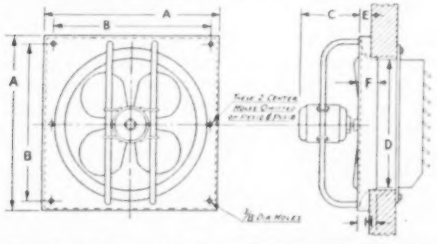
EASY TO INSTALL—Requires only 4 or 6 lag screws or bolts to mount. Opening may be round or rectangular—panel will cover all irregularities of cut opening.

GUARDS AVAILABLE—Neat appearing, protective guards for inlet side to eliminate hazards are available for all units.

EASY TO CLEAN—Streamlined surfaces allow cleaning in minimum time. Finished in gray Hammerloid baked enamel.

RATINGS—According to National Association of Fan Manufacturers and American Society of Heating & Ventilating Engineers.

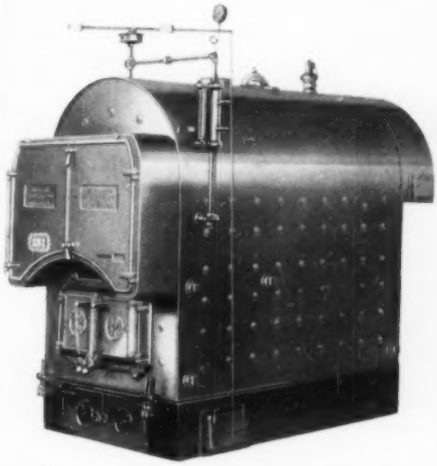
GUARANTEE—Peerless Electric Fans and Motors are guaranteed against defective workmanship or material for a period of one year from date of shipment from factory. Each unit, when shipped, is registered and the serial number identifies it immediately for spare parts or duplicates.



Model	Fan Diameter	Capacity C.F.M.	Motor H.P.	R.P.M. High	Recommended Shutter Size	FAN PERFORMANCE AND DIMENSIONS						Shipping Wgt.
						A	B	C	D	E	F	
PVS-16	16"	2150	1/8	1100	16"	24	22 1/8	8 1/2	16 5/8	1 1/16	2 1/8	55
PVS-18	18"	2900	1/6	1100	18"	26	24 1/8	12	18 5/8	1 1/16	3	75
PVS-24	24"	4550	1/4	820	24"	34	31 1/2	12 5/8	24 1/4	1 1/16	3 1/2	90
PVS-30	30"	7375	1/2	660	30"	40	37 3/4	13 3/4	30 13/16	1 1/16	3 11/16	115

THE Peerless Electric COMPANY
WARREN, OHIO

BURNHAM
COMPACT TYPE
WELDED STEEL BOILERS



Large capacity in less space

Take advantage of Burnham's long experience in building fine steel boilers. Here's quality and efficiency you can depend on. Burnham steel boilers are giving a good account of themselves in schools, apartment houses, churches and greenhouses all over the country.

Capacities range from 3,000 to 35,000 square feet.

The famous Burnham fire travel, 3 times back and forth the length of the boiler, scrubs maximum heat from the fire. Quick steaming without priming. Low water line—easily installed. Adaptable for all fuels. Can be equipped with tankless or storage type hot water coils.

Built in accordance with ASME Code. Ratings conform to SBI Code.

Burnham Corporation
"PIONEERS OF RADIANT BASEBOARD HEATING"
IRVINGTON, N. Y.

MAIL coupon today for folder SB-103 containing full details, ratings and installation data.

Burnham RADIANT HEATING SINCE 1873

Burnham Corporation Dept. HP-90
Irvington, N. Y.
Please send me Folder SB-103 on Compact Steel Boilers.
Name .....
Address .....
City ..... State .....

FREE BULLETIN

on how to drain corrosives

This 12-page bulletin tells you how, why and where you should use Duriron acid-proof drain equipment for corrosive wastes.

It includes—the physical, mechanical and corrosion-resisting properties of Duriron compared to other materials ...engineering data on Duriron equipment ... application in chemical laboratories, engraving plants and industrial acid waste systems ... proper installation practice.

Find out how you can protect your waste disposal system against costly corrosion. Use the coupon, today.

The Duriron Co., Inc.
Dayton 1, Ohio
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DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

DURCO ADV. 90-GM

The Duriron Co., Inc., Dayton 1, Ohio

Gentlemen:

Please send me your free bulletin 703.

Name _____

Company _____

Address _____

City _____ State _____

becomes assistant director of engineering, working directly under **Ralph C. Osborn,** vice president and director of engineering. **W. E. Flanders** becomes assistant product engineer and **C. R. Waldron** is assistant director of research.

As the new manager of heating sales for **Viking Air Conditioning Corp.,** Cleveland, **Richard F. Gang** will assist jobbers in the sale of blower packages and humidifiers and will work with furnace manufacturers on the application of humidifiers. He had been head of dealer merchandising of blower packages. . . . . **Morris Coupling and Clamp Co.,** Ellwood City, Pa., has elected **C. F. Maroney** president and **R. W. McGrew** secretary.

Frank D. Klein, formerly southeastern district manager for Typhoon Air Conditioning Co., Inc., is now managing the Atlanta district office of **Penn Electric Switch Co.,** Goshen, Ind. This office is now located at 1145 Peachtree St., N.E. . . . . **Peabody Engineering Corp.,** New York City, has appointed three division managers. **William Godley** is handling contract sales, **George E. Smith** is head of the air heater division and **Edward R. Clark** is managing the automatic oil burner division.

The new advertising manager for **Richmond Radiator Co.,** New York, is **Edwin Reichert.** Before joining the firm he was assistant advertising manager for Riegel Paper Corp. and Riegel Textile Corp. Two new Richmond sales representatives are **Ernest T. Scott,** who is covering North Carolina, Virginia and parts of West Virginia, and **Edward Jay,** whose territory is the state of Florida. Mr. Scott was formerly general manager of Loman Supply and Equipment Co., and Mr. Jay was formerly with a wholesale plumbing supply company in Miami.

F. J. Hollerbach is managing sales for **Automatic Firing Corp.,** St. Louis. He was formerly sales manager of El Van Oyro, a Detroit corporation, and for several years was manager of the heating division of Sears Roebuck & Co. in Michigan. He was eastern district representative for Automatic Firing in 1946 and 1947.

National Radiator Co., Johnstown, Pa., has opened a Pacific branch sales office at 681 Market St., San Francisco, with **Robert E. Daly** in charge. **Herbert Van Kuran** has joined the Pacific sales staff as successor to Mr. Daly, who was formerly northwest sales representative with offices in Seattle. Until recently, Mr. Van Kuran was manager of the Seattle branch of Grinnell Co. of the Pacific. The new branch office will be responsible for sales in California, Oregon, Washington, Nevada, Idaho and Utah.

Robert G. MacDonald has joined **Heil Co.,** Milwaukee, as director of industrial relations. He is former commissioner of the U. S. Mediation and Conciliation Service in Milwaukee and for the past five years he directed industrial relations at Geuder, Paeschke and Frey Co.

SKF Industries, Inc., Philadelphia, has established an 11 state region, with headquarters in San Francisco, which will include territory now serviced by district offices in San Francisco, Los Angeles and Portland and by the Denver branch office. The new territory includes

If you pipe it...there's a Fairbanks® valve to control it

Here are two typical examples of the outstanding design, sound engineering and rugged construction that are built into every Fairbanks Valve. Years of experience in meeting all kinds of valve requirements for industry, have given Fairbanks Engineers a storehouse of knowledge in controlling the flow of water, steam, gas, oil, chemicals, etc. Consult them without obligation.

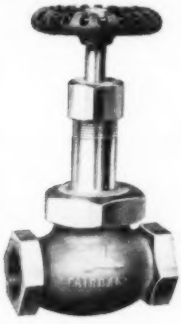


Fig. U-01
Renewable Composition Disc
Globe Valve — 150 lb. S.W.P.

Fig. 0236
UNION BONNET
— Renewable
Nickel Alloy Seat
Gate Valve —
200 lb. S.W.P.

THE **Fairbanks** COMPANY

General Offices:
393 LAFAYETTE STREET, NEW YORK 3, N.Y.

Branch Offices:
393 Lafayette St., N.Y.3, N.Y. 520 Atlantic Ave., Boston 10, Mass.
15 Ferry St., Pittsburgh 22, Pa. 202 Division St., Rome, Ga.

VALVES
DART & PIC UNIONS • TRUCKS • CASTERS

PROVED IN A MILLION INSTALLATIONS!

This is the Dodge Bronzoil Bearing—one of the most remarkable items available to fan and blower manufacturers. Engineered especially for fan and blower service. Refined over the years to meet the *many* exacting needs of such service. It is THE bearing to tie to for product dependability, *as proved in a million installations.* WRITE for literature and details.

Bronzoil BEARING

- Ideally suited to domestic units. Shaft sizes from 3/4" to 1¼".
- Self-oiling composition bushing feeds oil to shaft by capillary action. Bushing shoulder provides self-lubricating bearing surface for collar.
- Absorbent filler holds oil in reservoir. Prevents over-lubrication.
- Spherical surfaces provide full self-alignment.
- Slotted bolt holes. Neoprene, static-proof, oil resistant grommets are available for sound isolation.
- Split pressed steel housing. Strong, yet light.

DODGE MANUFACTURING CORPORATION
1600 Union Street • Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. He's factory-trained to help solve your power drive problems. Look for his name under "Power Transmission Machinery" in your classified telephone directory.

the states of Washington, Oregon, California, Idaho, Utah, Wyoming, Montana, Colorado, Arizona, New Mexico, western Nebraska and the city of El Paso, Tex. **J. C. Bowman,** district manager in San Francisco since 1936, is the new regional manager.

Ward Leonard Electric Co., Mount Vernon, N. Y., has named **James E. Reagan** assistant manager in charge of sales promotion and advertising. He joined the company in 1937 as a sales engineer and formerly handled sales promotion activities. Since 1945 he has been editor of the company's house organ.

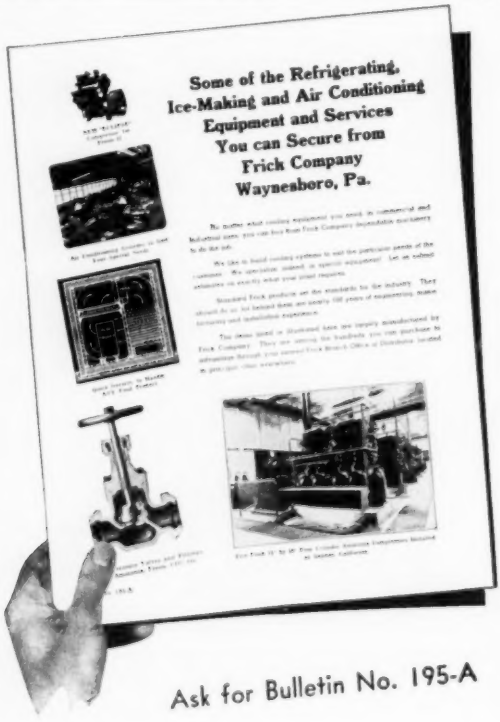
Five new district sales managers have been appointed by **Timken Silent Automatic Div., Timken-Detroit Axle Co.,** Jackson, Mich. They are: **Thomas McClure, Jr.,** northern Indiana; **R. J. Mackay,** western New York; **H. J. Vaughn,** western Pennsylvania; **John Meiners, Jr.,** southern Indiana and Kentucky; and **E. S. LeMoine,** eastern Canada.

Ray Cooper has been promoted to district sales manager for the state of Oklahoma by **Servel, Inc.,** Evansville, Ind. Since 1946 he has worked out of the company's regional office at Dallas, Tex. . . . . **R. M. Brown,** formerly sales engineer with Bristol Co. of Canada, Ltd., and lately instrumentation engineer with Stadler Hurter & Co., Montreal consulting engineers, has rejoined **Bristol Co.,** Waterbury, Conn., and will be stationed in Baltimore.

Edward Valves, Inc., East Chicago, Ind., has appointed **I. Russell Berkness Co.,** Richmond, Va., as sales and service representative in that state. The firm is headed by **I. Russell Berkness,** a well known Virginia engineer who formerly did consulting work in Richmond and Norfolk. . . . . **Fred H. Schaub Engineering Co., Inc.,** Chicago, has named **Lankton Industries of St. Louis,** 7908 Bonhomme Ave., Clayton 5, St. Louis, as exclusive representative in eastern Missouri and southern Illinois. **E. Paul Harder,** head of the firm, has had 18 years of experience in the design and application of steam specialties, return systems, pumps, boilers, etc.

A. A. Englehardt, who has been in the sales organization of **Eclipse Fuel Engineering Co.,** Rockford, Ill., for 14 years, is now district sales representative in Chicago where new and more spacious quarters have been leased at 4209 S. Western Ave. . . . . **John Brinda** has joined **Madden Brass Products Co.,** Chicago, to head its newly created customer service department. He will also supervise advertising and sales promotion. Mr. Brinda was formerly associated with Tempco Supply Co., a Chicago refrigeration supply jobber, in charge of purchasing, sales and advertising. He was also a director of that company.

Anticipating the opening of its new plant in Ukiah, Calif., **Masonite Corp.,** Chicago, has expanded its western sales division and appointed **George M. Syversen** as director of western sales. Since 1946 he has been manager of the sales engineering department. Orders from customers in California, Oregon, Washington, Idaho, Utah, Nevada, Arizona and New Mexico will be processed by the division sales office at 111 Sutter St., San Francisco.


Some of the Refrigerating, Ice-Making and Air Conditioning Equipment and Services You can Secure from Frick Company Waynesboro, Pa.

Ask for Bulletin No. 195-A

Get This New Bulletin!

It has nearly 70 photographs and drawings of equipment you can use in solving your cooling problems. And a complete check list of ALL the items you may need.

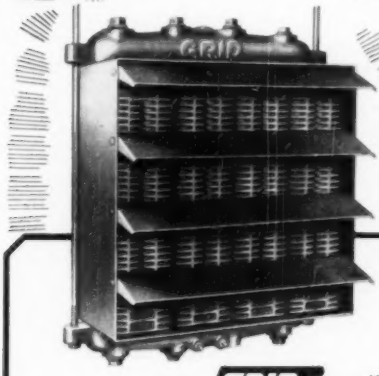
This has been wanted for a long time. Designers, owners, and operators are enthusiastic about it. Get your complimentary copy now: it will help you order equipment wisely. Write, wire or phone

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.
Also Builders of Power Farming and Sawmill Machinery

DO YOU KNOW..

That it's possible

TO GO THROUGH MANY HEATING SEASONS WITHOUT UNIT HEATER MAINTENANCE EXPENSE, providing yours is a GRID installation? GRID Units installed in industrial plants in 1933 are still operating at peak efficiency. These plants do not recall having spent maintenance time on them. This performance is possible because:



GRID cast iron construction withstands corrosive fumes.

GRID wide fin spacing facilitates easy cleaning.

GRID will withstand steam pressures up to 250 lbs., and is free of electrolysis.

GRID design incorporating proper fan sizes, motor speeds and outlet temperatures results in a properly balanced heating unit, especially when high steam pressures are used.

GRID fins are cast integral with the steam chamber assuring even distribution of heat. It's not possible for GRID fins to come loose from the steam chamber to cause loss of heating efficiency.

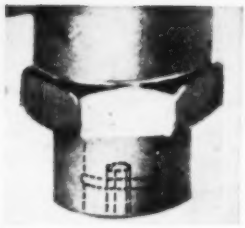
No other unit heater incorporates these features that are vital to proper and efficient industrial plant heating.

INVESTIGATE today GRID systems of high pressure unit heaters, blast coils, and radiation . . . the answer to maintenance-free heating in the industrial plants.

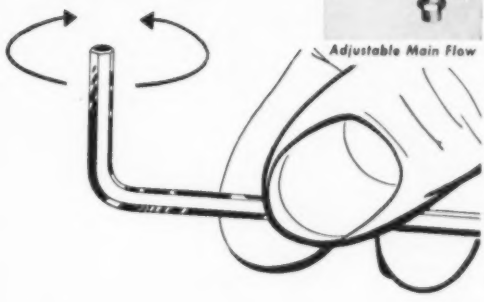
Some Territories Still Available

for sales representatives. Write us for details . . . Outline your setup and experience.

D. J. MURRAY MANUFACTURING CO. WAUSAU WISCONSIN



Adjustable Main Flow



Adjustable Oil Burner Automatic Valves

Adjustable By-Pass

The Main Flow adjustment in Bulletin 8281 Valve permits the operator to regulate the flow of oil through the valve when it is open. It's a "regulating" as well as a "Shut-Off" Valve. When de-energized, it closes fully, shutting off the flow completely. It is Factory Mutual Approved.

The By-Pass adjustment in Bulletin 8291 Valve permits a "high or low" flame operation. In other words, the amount of flow can be controlled for full flow or by-pass flow automatically by instrument. It is not a Shut-Off Valve, however, since it does not close completely.

These two ASCO Control Valves are for special cases. Both come in ⅜ and ½ inch pipe size. Both are suitable for gas, light oil, heavy oil (No. 4, 5, 6 and Bunker C) air, water and other non-corrosive fluids at temperatures up to 212° F.

We have other types of Automatic Solenoid Valves for Shut-Off and other purposes not only in the restricted flow types, as these two valves, but in the full flow class. If you will tell us about your automatic control problems, we shall be glad to recommend the proper type.

ASCO Solenoid VALVES

When in need of Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Specialized Electromagnetic Controls, come to us.

Automatic Switch Co.

389 LAKESIDE AVENUE · ORANGE, NEW JERSEY

CONVECTOR Elements

COPPER TUBE, ALUMINUM FIN, CAST HEADERS
POSITIVE FIN TO TUBE THERMAL BOND
RIGID CONSTRUCTION
EASY MOUNTING
CODE RATED

Send for Bulletin C155
KRAMER TRENTON CO. Trenton 5, N. J.

J. Nall Candler, formerly assistant general manager of the Norge Div., Borg-Warner Corp., is now administrative assistant to **F. M. Hawley,** president and general manager of **Morse Chain Co.,** Detroit, a division of Borg-Warner. **Robert N. Black** is the new supply manager of **Borg-Warner International Corp.** He joined this organization in 1947 and was previously an accountant with General Motors Corp.

Jack Kasrel, 1915 W. 62nd St., Chicago, has been made district sales manager for Chicago and northern Illinois, as well as the Calumet area in Indiana, by **J. C. Whitlam Mfg. Co.,** Wadsworth, Ohio. **Manuel Shaftel,** 685 Broadway, Brooklyn, N. Y., is now covering Brooklyn and Long Island.

Kritzer Radiant Coils, Inc., Chicago, has appointed four new representatives. **Pat Savage,** 155 E. 44th St., New York, is covering metropolitan New York and a number of counties in the states of New York, New Jersey and Connecticut. **Frank Prawl,** of **Prawl Engineering Corp.,** 2820 Harney St., Omaha, is handling representation in the state of Nebraska and portions of Iowa, and **A. A. Aikin,** of **AAA Engineering Sales Co.,** 1220 Turner St., Lansing, Mich., is covering that state. **Bernard A. Thomas,** 405 E. Idlewild Ave., Tampa, is the new Florida representative.

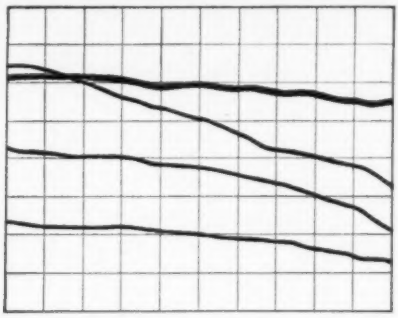
Six new representatives of **Fitzgibbons Boiler Co., Inc.,** New York, are: **Charles E. Barnhart, Albuquerque Engineering Co.,** 2722 Hyder Dr., Albuquerque, N. M.; **J. L. Brown,** Terminal Warehouse, Little Rock, Ark.; **David J. Rank,** 307 Southern Trust Bldg., Louisville 2; **Thermal Engineering Co.,** 810 Bona Allen Bldg., Atlanta 3; **West Texas Distributing Co.,** 4th St. & Avenue T, Lubbock, Tex.; and **Dan H. Woodruff Co.,** 407½ Union St., Nashville, Tenn.

R. J. Clark Equipment Co., Inc., Clearwater, Fla., is handling the sales and servicing of heating products in Florida for **C. A. Dunham Co.,** Chicago. **Robert J. Clark** heads the firm which has branch offices in Jacksonville, Orlando and Miami. . . . Representation of **Illinois Engineering Co.,** Chicago, in eastern Iowa and western Illinois is now being handled by **Harold F. Smith,** 314 First National Bldg., Davenport, Ia. **Mechanical Equipment Co.,** 1817 Central St., Jackson, Miss., is the new representative in that state.

Swartwout Co., Cleveland, has appointed **Kenneth P. Hengesbach** as power plant equipment sales engineer in the company's Philadelphia district office. He was formerly with Molded Specialties Co., Inc., and Independent Pneumatic Tool Co. . . . Four recent appointments to the staff of sales engineers of **General Controls,** Glendale, Calif., include **William Charles Stringfellow** to the Dallas branch office, **Hamilton G. Sudler** to New York, **Earnest F. Bruegel** to Philadelphia, and **R. Roedder** to Los Angeles.

With headquarters at 123 S. Broad St., **T. J. George** is the new district sales manager in Philadelphia for **Sawhill Mfg. Co.,** Sharon, Pa. **D. M. Middleton** is representing the company in western Pennsylvania, West Virginia and Ohio and is working out of the home office.

THE LOWDOWN ON INSULATION



Efficiency is as efficiency does

Remember the old saying—"Handsome is as Handsome does"? Just change that word "handsome" to "efficiency," and you're talking about low-temperature insulation.

The smart insulation buyer realizes that theoretical or laboratory efficiency isn't the whole story, by any means. He wants his insulation to keep on delivering efficiency in his cold-room walls.

One of the grand things about Novoid Corkboard insulation is the dependable way it stays efficient year after year in actual service. Our customers keep coming back for more. (Satisfaction—not force of habit—is the reason for that.)

Of course, Novoid Corkboard is made here in the United States, under strict quality control. And it's installed by some of the most experienced, dependable men in the business. It's about as good a way to keep refrigeration costs down as you can possibly find. If conflicting insulation claims are bothering you, just write to us. We'll be glad to send you the "lowdown." Novoid Cork, Englewood, N. J.

Consider EVERY factor when you buy insulation

Check list of insulation properties

	Novoid Cork Insulation	Many Other Insulations
First cost	moderate	low to high
Installation cost	low	moderate to expensive
Eventual cost	low	high
Efficiency	remains high	generally deteriorates
Moisture resistance	excellent	some good, some poor
Vapor seal	simple	complicated or difficult to install
Structural strength	very good	some non-existent, others fair
Weight	very light	varies
Resilience	considerable	from fair to complete rigidity
Settling	none	a serious problem
Supporting structure	none	elaborate
Fire resistance	good	excellent to poor
Vermin resistance	good	excellent to very bad
Odor absorption	none	some are regular sponges

with a GREENLEE HYDRAULIC BENDER

Yes, make pipe bends "right on the job" . . . exactly where and when you need them! And do the job swiftly, accurately with a GREENLEE Hydraulic Pipe Bender.

Bends pipe up to 4½". Simple to operate, easy to carry, set up and shift from job to job. With a GREENLEE *one man* makes smooth, precise, uniform bends in but a few minutes. Speeds your piping installations, cuts costs on labor and materials. In timesavings alone, the GREENLEE pays for itself quickly.

Ideal for radiant heating jobs, too. For complete details write for free Bender Booklet E-201. Greenlee Tool Co., Division of Greenlee Bros. & Co., 2349 Twelfth Street, Rockford, Illinois.

TOOLS FOR CRAFTSMEN
GREENLEE

NEW BOOKS & REPORTS

Refrigeration Safety Code Approved and Published

The revised Safety Code for Mechanical Refrigeration, commonly known as the American Standard B9 Code, has been thoroughly revised, superseding the old 1939 edition of B9. The American Society of Refrigerating Engineers is sponsor of the code which has been adopted as an industry standard by the American Standards Association.

The revised code is the result of several years' effort by an ASA sectional committee composed of 77 members and several subcommittees with more than 25 members. These members represent every phase of the refrigeration industry as well as casualty and insurance groups, the Bureau of Explosives, the valve and fittings industry, the National Fire Protection Association, the Underwriters' Laboratories, and many others.

The new code is considerably more comprehensive than its predecessor. Additions have been made to clarify controversial sections in the old code and to cover new equipment and installation procedures which have been adopted since the war. In general, all of the requirements are much more specific, more to the point, and more readily understood. Certain of the requirements dealing with piping, copper tubing, and fittings have been brought up to date and clarified.

The sponsor of the code is emphatic in recommending that municipalities and states adopt it in its entirety as "a great deal of the value of the code is lost if only sections of it are followed and practiced; the code is built, one regulation upon another, and to use it piecemeal is to destroy the effectiveness of the document." An interpretations committee has been formed since the code was issued to interpret and explain any provisions and to keep it abreast of the advancements in the art of refrigeration.

Copies are available from ASRE headquarters, 40 W. 40th St., New York 18, for $1.00.

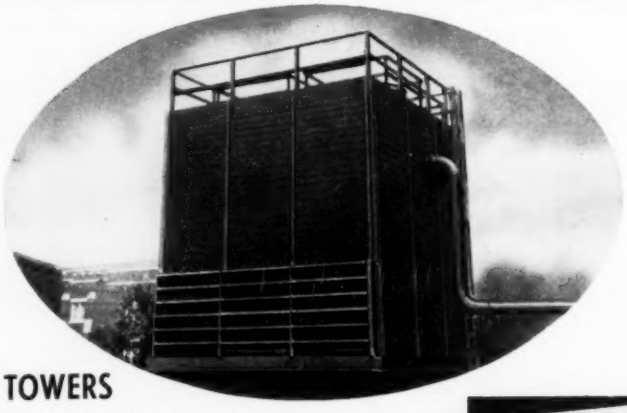
Plant Engineering Handbook Covers Operation, Maintenance

Plant Engineering Handbook tells how to manage, operate and maintain industrial plants and presents the essentials of good plant engineering practices in 77 major areas of plant operation and maintenance.

William Staniar, editor-in-chief, was formerly in charge of all mechanical power installations at 85 plants of E. I. du Pont de Nemours and Co. He has been assisted by 86 contributing authors, each an authority in his respective field.

Among the many subjects covered in the 35 chapters are refrigeration, industrial instrumentation and control, industrial piping, welding, lubrication, mechanical packings, industrial process air conditioning, drying, metallurgy and corrosion, heat transfer and heat transfer properties of materials, and vibration control and noise reduction.

Published by McGraw-Hill Book Co., 327 W. 42nd St., New York City, the 1955 page volume contains 1487 illustrations, 544 tables, and is priced at $15.00.



Left: United one cell induced draft tower, series M16, in ice plant refrigeration service.

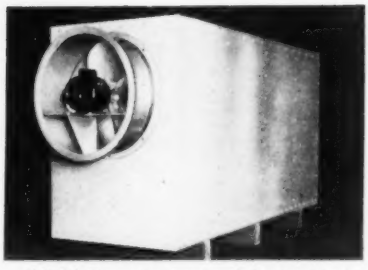
UNITED COOLING TOWERS

for Air Conditioning and Refrigeration

Complete line "package" type spray towers at low standardized prices.

Individually designed and constructed mechanical draft equipment in any required capacity.

Write for Bulletin No. 50 showing typical United installations in power, oil, gas and refrigeration service.

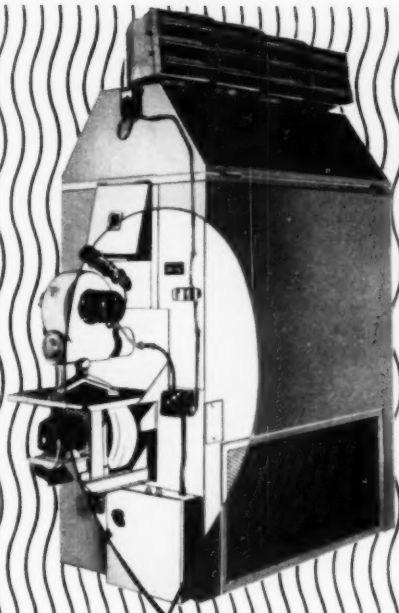


United LoTemp series, forced draft "packaged" unit. 5—7.5—10—15—20 ton capacities.

UNITED COOLING TOWER CO.

PORTER BLDG. KANSAS CITY 2, MISSOURI

Authorized Representatives in Principal Cities



easy on the outside

. . . . All accessories are mounted outside the heater where they can be serviced without dismantling the unit. A bearing, for example, may be replaced in a few minutes without prolonged interruption of heat supply.

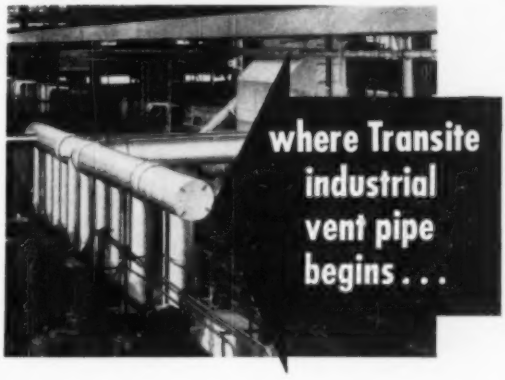
Olson

ARTHUR A. OLSON & COMPANY
Broad Street, Canfield, Ohio

DIRECT FIRED HEATERS
Gas, Oil, Coal
or Dual Gas and Oil

Get the inside story
Write for catalog
No. F50HL

Tough venting problems end . . .



YES . . . Transite* Industrial Vent Pipe solves many a venting problem because it resists the attack of many corrosive fumes, vapors and gases day in and day out . . . and seldom requires maintenance.

That's because Transite is a tough, durable asbestos-cement product that cannot rust or rot. It has a high degree of chemical stability which enables it to stand up for years under corrosive conditions which would destroy many other pipe materials in a much shorter time. It has been able to substantially reduce replacement and maintenance costs for venting systems throughout countless plants in all types of industries.

It's easy to install—because Transite Pipe is light in weight, easy to handle. It can readily be cut and drilled with ordinary tools.

And it's adaptable—for Transite Pipe comes in a range of sizes up to 36" in diameter that can be used for vents, ducts, or stacks. Furthermore, a complete line of Transite fittings permits you to make your *entire* venting system corrosion-resistant.

Just write to Johns-Manville, Box 290, New York 16, N. Y. for further information on Transite Industrial Vent Pipe. Ask for Data Sheet Series DS-336.

Complete line of fittings enables Transite Industrial Vent Pipe to be fitted to any situation—around sharp curves, changes of direction, manifold connections, etc.

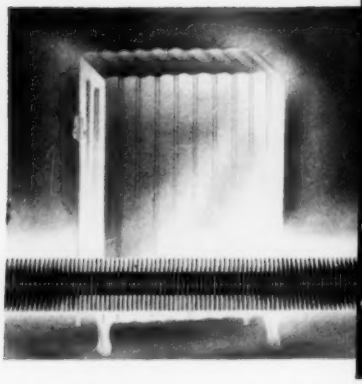
*Transite is a Johns-Manville registered trade mark.

Typical Industries in which Transite Industrial Vent Pipe is used:

Aircraft	Foundry	Pulp & Paper
Automobile	Furnace	Quarrying
Baking	Furniture	Railroad
Bleaching	Gas	Rayon
Boiler Works	Glass	Refrigeration
Brewing	Laboratory	Rubber
Canning	Laundry	Shipbuilding
Ceramic	Leather	Shoe
Chemical	Match	Smelting
Dairy	Meat Packing	Soap
Drug	Metal	Soft Drink
Electrical	Mining	Sugar Refining
Explosives	Paint	Textile
Farm Machinery	Petroleum	Tool
Food	Potash	Water & Sewage

Johns-Manville
TRANSITE Industrial Vent PIPE

Here's how to.....



- SAVE THIS SPACE
- PROVIDE LOWER COST
- REDUCE TIME AND LABOR INSTALLATION
- BOOST HEAT-TRANSFER EFFICIENCY

..install KRITZER COMMERCIAL COIL SECTIONS

These sections, consisting of collared fins mechanically bonded directly on pipe, provide the most efficient heat transfer on the market today and weigh but a fraction of cast iron radiators.

Supplied to order in maximum 10′ lengths, they are simple to fit, quicker to install. Their sturdy construction provides an enormously-extended, extra-effective radiating surface.

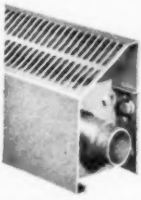
Write for our informative "Fin-Pipe" Commercial Coil Folder today!

ENCLOSURES DESIGNED BY KRITZER MEET EVERY INSTALLATION NEED!

A complete new line of ornamental covers is now furnished for Kritzer Coil Sections. These covers make heating units more attractive, eliminate buying extra radiator covers. Just select the cover style that is best suited for the type of mounting and installation you have in mind.

UTILITY ENCLOSURE

For factories, garages, and other locations where a simple, sturdy protective cover is needed for Kritzer Commercial Fin-Pipe Coils.



WALL-MOUNTING ENCLOSURE

For schools, offices and other installations where wall-mounting is desired, and where a more decorative cover is indicated.

UNIVERSAL BASE-BOARD ENCLOSURE

Available in Standard and Recessed Models, for hospitals, hotels, apartments and other locations where space-saving is important.

Kritzer also manufactures Radiant "Fin-Tube" Coils, and complete line of Radiant Baseboard Coils for residential use.

KRITZER RADIANT COILS, INC.

2905 LAWRENCE AVENUE, CHICAGO 25, ILLINOIS

"IF IT'S KRITZER, IT'S RIGHT, SIR!"

Measures Thermal Diffusivity of Soil by the Use of a Heat Pump

An experimental investigation was conducted in 1949 at the University of Kentucky to determine the thermal diffusivity of a soil by the use of a heat pump. An earth heat pump was operated to abstract heat from soil which was assumed to be in thermal equilibrium. Temperature-time graphs of the antifreeze and of the soil at distances of 6, 12, and 18 in. below the center of the antifreeze line were plotted from experimental data. From these graphs data were obtained from which the thermal diffusivity of the soil was calculated. The soil was analyzed and found to fall in the general Casagrande classification of lean clay (*CL*) with low plasticity. The average value of the thermal diffusivity of the soil was found to be 0.019 sq ft per hr with the soil at a density of 120 lb per cu ft.

The report of the investigation is contained in a paper, Measurement of the Thermal Diffusivity of a Soil by the Use of a Heat Pump, by E. B. Penrod, department of mechanical engineering, which is published in the Vol. 21, No. 25 issue of the Journal of Applied Physics of the American Institute of Physics, 57 E. 55th St., New York 22.

ASRE Booklet Contains Properties of Refrigerants

A handy booklet, Refrigerant Tables, Charts and Characteristics, containing a compilation of refrigerant properties in chart and table form has been issued by the American Society of Refrigerating Engineers.

This 93-page booklet contains in one volume tables of properties, pressure-enthalpy diagrams, and Mollier charts for all commonly used refrigerants. While the material duplicates similar data which can be assembled from several textbooks, the form of the tables has been rearranged and improved and the tabular material critically re-examined and brought up to date. The data in the book has been reprinted from the Fundamentals Volume of the ASRE Data Book which was issued in 1949.

Copies may be obtained from ASRE headquarters, 40 W. 40 St., New York 18, for $1.50, bound in paper, and $2.00, bound in cloth.

Other Books and Reports Received

Report on the Strength of Wrought Steels at Elevated Temperatures, published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, paper covered and priced at $3.00. Identified as Special Technical Publication No. 100, this report was prepared by R. F. Miller and J. J. Heger, of Carnegie-Illinois Steel Corp., and gives a great deal of information on the chemical and physical properties.

Largely a graphical presentation, data for the report were gathered from a wide variety of sources as noted in the book. An important feature is the inclusion of standard commercial grades of steel, data on tensile, creep, and rupture properties being given. The report is in two section, the first 52 pages covering plain carbon and alloy steels containing molybdenum and chromium up to 3 percent. The second part covers ferritic and austenitic steels with more than 5 percent chromium.

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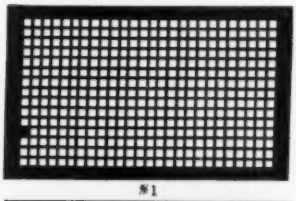

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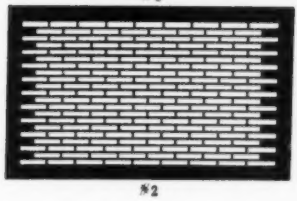

#2

Here are several illustrations to help show the variety of the A-J line.

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#2—Slotted Design—73 to 75% free area. Particularly suited to tasteful architectural motifs.

#3—Double Diffusers. Ideal for jobs where large volumes of air must be controlled. Also available as single diffusers where horizontal deflection is not required.

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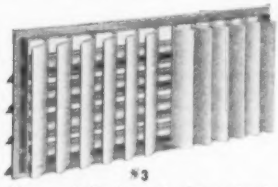

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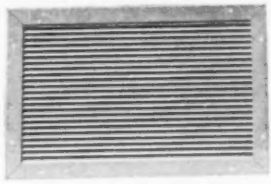

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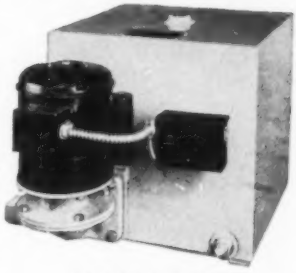
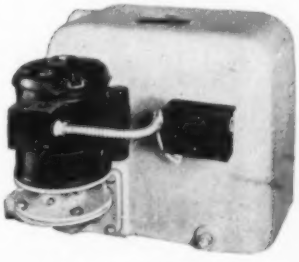


4126-B Condensation Pump (Steel Tank)



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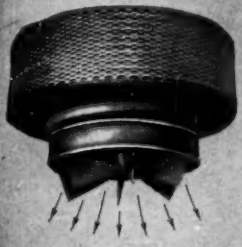

A proven heating unit, modern in design, incorporating every unit heater advancement. McCord copper spiral fin tube construction creates air turbulence without undue restriction. Improved fan blades deliver large volume of air with minimum air noise. Guaranteed for 150 lbs. saturated steam pressure. Specify McCord.

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A time proven heating unit, modern streamlined in design, quiet, yet its rugged construction adapts it to all types of installations, guaranteed for use on No. 150 p. s. i. steam pressure. All copper heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Wide range of capacities.

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Welding Bibliography—The department of welding engineering, Ohio State University, Columbus 10, is offering Engineering Experimentation Circular 51, Holdings in the A. F. Davis Welding Library. Single copies are free as long as the present supply lasts. The booklet was published in answer to many requests for information on published works in the welding field. This list of titles is not meant to be a complete bibliography but is published to assist corporations, individuals, and other libraries in using the Davis Library or in building their own collections. The department is also offering Engineering Experiment Station Bulletin 140, Patent Classification in the A. F. Davis Welding Library. This booklet gives the outline of the Patent Classification Index and explains in detail the operation and use of the system.

Hourly Wage Rates in the Building Trades—This 1950 national wage chart, showing hourly wage rates paid building mechanics in principal cities of the United States and Canada, has been prepared by the Builders Association of Chicago, Inc., 228 N. LaSalle St., Chicago 1. Copies may be obtained for $1.50.

Solders and Soldering, Circular 492, National Bureau of Standards—Describes soft solders, precious metal solders, and common brazing solders. Instructions are given for the proper use of each type of solder for joints of the required strength. All common soldering alloys are listed and their component elements, together with melting ranges, are given. Copies may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for 15 cents.

Symposium on Evaluation Tests for Stainless Steels—A 236 page paper covered booklet available from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, for $2.50. This symposium, held at the 52nd annual meeting of the ASTM, presents a critical appraisal of some of the testing methods that are in regular use for evaluating certain corrosion resistant characteristics of stainless steel alloys. At the symposium, special attention was focused on (*first*) the significance of results of the laboratory evaluation tests with relation to practical experience under diverse service conditions and (*second*) the effects, on the behavior of the alloys in test and in use, of lowering carbon contents to extremely low limits.

Recommended Practices for Resistance Welding—60 pages, published by the American Welding Society, 33 W. 39th St., New York 18, and priced at $1.00. This new, revised, and enlarged edition is a modification and expansion of the standard originally issued in tentative form in 1946. Recommended practices cover spot, seam, projection, and flash welding and standard methods are given for testing resistance welds.

Bibliography on Machinery Foundations—Design, Construction, Vibration Elimination—This is a list of 120 annotated references to selected books and periodical articles published from 1924 to 1949 on the theory, design and construction of machinery foundations. Copies of ESL Bibliography No. 5 may be purchased from Engineering Societies Library, 29 W. 39th St., New York 18, for $2.00.

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Builders Flo-Watch gives you the complete story on boiler feedwater in a single, space-saving instrument. You get recording, totalizing, indicating of flow — or any combination — in this attractive 14⅝" by 20¼" instrument. Flo-Watch is mechanically actuated . . . responds accurately (within 1%) to the flow through Venturi Tube, Nozzle, or Orifice Plate. The seven-digit, cyclometer type totalizer, the large 10" indicator with evenly spaced graduations, and the uniformly graduated 12" chart tell the facts at a glance. Flo-Watch can be installed anywhere within the plant . . . can also be employed to pace chemical feeders and other secondary equipment. For Bulletins and complete information, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 381 Harris Ave., Providence, Rhode Island.

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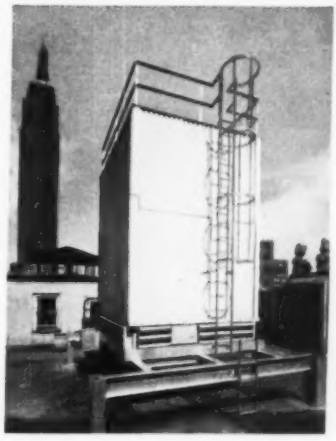

★ The installation of the above Phillips Tower, which was engineered and installed by Mr. D. A. Zilli as a part of the modernization of the Hotel Vanderbilt, New York City, is now saving 21,000 gallons of water for each hour of operation on a 125 ton air conditioning system.

This tower is designed to give long lived operation with minimum maintenance costs. Corrugated Transite was used for the shell, which was attached to a structural steel frame, hot dipped galvanized after fabrication.

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MEETINGS & CONVENTIONS

I-B-R Heating School—Begun in Springfield, Mass., in April and sponsored by the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17, a traveling school is designed to provide an intensive three-day training in heating design and installation. The instructor is Arthur L. Wales, field training director for the institute, and the tuition fee is $18.00. Classes will be held this month in Cleveland, Detroit, Milwaukee and Minneapolis and next month in Duluth, Davenport, Ia., St. Louis, Indianapolis, and Chicago. Classes scheduled for November will be held in South Bend, Toledo and Hartford, Conn., and similar sessions will be held during December in Worcester, Mass., and Bridgeport, Conn.

Instrument Conference and Exhibit—Sponsored by the Instrument Society of America, 921 Ridge Ave., Pittsburgh 12, the 1950 Instrument Conference and Exhibit will be held in the War Memorial Auditorium, Buffalo, N. Y., from September 18 to 22. This will be the fifth national conference and exhibit of the Society.

The ISA preconference instrument maintenance clinic, which was held for the first time last year, will be held again on the Friday, Saturday, Sunday immediately preceding the conference. The clinic will be held in rooms of the New York State Institute of Applied Arts and Sciences, Buffalo, and will consist of ten 2 hr sessions.

The 1951 conference and exhibit will be held September 10 to 14, at the Coliseum, Houston, Tex.

American Society of Mechanical Engineers, 29 W. 39th St., New York City—The fall meeting is scheduled for September 19 to 21, Hotel Sheraton, Worcester, Mass. Among the papers scheduled for presentation are:

Report of Progress on Measurements of Friction Coefficients, Recovery Factors, and Heat Transfer Coefficients for Supersonic Flow of Air in a Pipe, by Joseph Kaye, J. H. Keenan, and William H. McAdams, Massachusetts Institute of Technology

Pressure Drop and Heat Transfer for Subsonic Air Flow in a Smooth Pipe, by Warner Goldsmith and R. A. Seban, University of California

Heat Transfer through Gases at Low Pressures, by P. P. Werlein, Illinois Institute of Technology, and Walter Fagan, Argonne National Laboratory

Ultrasonic Flaw Detection in Pipes by Means of Shear Waves, by C. D. Moriarty, General Electric Co.

Bolted Joints for Piping Materials Having Widely Different Coefficients of Expansion, by E. G. Schmidt, E. P. DeCraene, I. H. Carlson, and W. S. Black, Crane Co.

Problems of Conversion from Coal Firing to Oil Firing, by David H. Little, Boston Edison Co.

Standardized Boiler Units, by Carl E. Miller, Combustion Engineering-Superheater, Inc.

Dust Hazards Relative to Grinding Operations, by K. T. Benedict, Norton Co.

The society's annual meeting will be held November 26 to December 1, Hotel Statler, New York City.

Corrosion Short Course, sponsored by the National Association of Corrosion Engineers and scheduled for September 25 to 29 at Case Institute of Technology, Cleveland. Nine 2 to 2½ hr lecture periods with time for discussions are planned, and the course is designed as a refresher for those actively engaged in corrosion prevention but will not be too advanced for those just entering the field. Housing is available in a hotel adjacent to the campus and meals will be served in the

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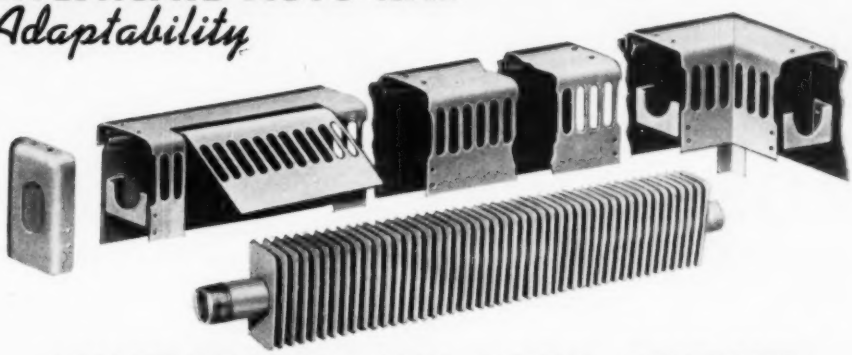

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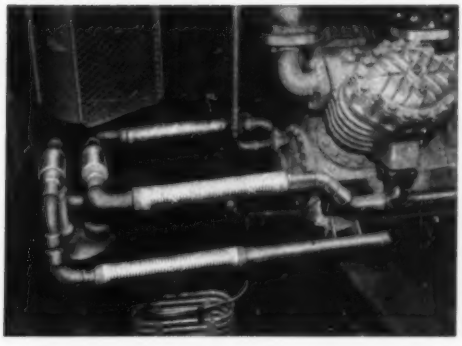

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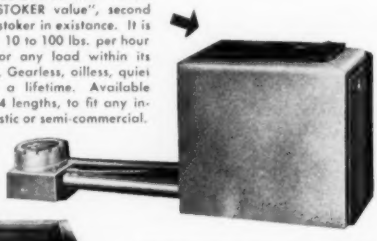
This is the famous GROSS-AIRE "America's Greatest STOKER value", second oldest domestic stoker in existance. It is adjustable from 10 to 100 lbs. per hour — can be set for any load within its range EXACTLY. Gearless, oilless, quiet — built to last a lifetime. Available in two models, 4 lengths, to fit any installation, domestic or semi-commercial.



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college cafeteria. Further information and application blanks may be obtained from Dr. R. B. Hoxeng at Case Institute.

American Gas Association, 420 Lexington Ave., New York 17—The 1950 annual convention will be held October 2 to 6, Atlantic City. Haddon Hall has been designated as headquarters for the accounting section; the Ritz Carlton hotel will be headquarters for the residential gas section and the industrial and commercial section; and the Dennis hotel will be headquarters for the operating section.

Instrumentation Symposium—The Agricultural and Mechanical College of Texas, College Station, Tex., is offering its fifth symposium on Instrumentation for the Process Industries, October 11 to 13. The course will be conducted as a seminar with lectures and discussions on the measurement and control of temperature, pressure, liquid levels, time control, and other allied subjects.

Anyone living either in or outside Texas may take the course on payment of a $5.00 registration fee. Rooming accommodations and meals will be available on the campus. Further information may be obtained from Prof. P. G. Murdock, of the chemical engineering dept.

1950 Public Works Congress and Equipment Show— October 15 to 18, Ninth Regiment Armory, New York City. The 1950 Public Works Equipment Show will be held in conjunction with the 56th Annual Congress of the American Public Works Association, 1313 E. 60th St., Chicago 37. Frederick H. Zurmuhlen, commissioner of public works for New York City, is general chairman of the conference which will be held at the Armory and the Hotel New Yorker.

National Association of Housing Officials, 1313 E. 60th St., Chicago 37—The 17th annual meeting and the Building and Maintenance Products Exhibit, October 16 to 19, Detroit.

The 38th National Safety Congress and Exposition, October 16 to 20, Chicago—Sessions on industrial safety will be held in the Stevens, Morrison, and Congress hotels. Additional information may be obtained from R. L. Forney, general secretary, National Safety Council, 425 N. Michigan Ave., Chicago 11.

Refrigeration & Air Conditioning Contractors Association, 228 N. La Salle St., Chicago 1—The 5th annual convention will be held November 15 and 16 at the Hotel Lafayette, Long Beach, Calif. The affair will be held to coincide with the west coast refrigeration and air conditioning conference and exhibit.

Refrigeration and Air Conditioning Conference and Exhibit, sponsored jointly by the Refrigeration Equipment Manufacturers Association and the Refrigeration Service Engineers Society—The remaining three conferences in a series of four will be held November 17 to 19, Municipal Auditorium, Long Beach, Calif.; January 26 to 28, State Fair Grounds, Dallas; April 6 to 8, Hotel Statler, Buffalo.

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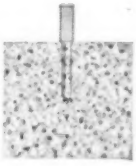

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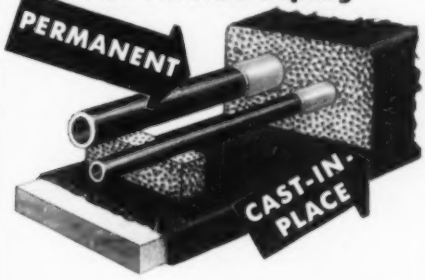

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1. **More efficient** than most other methods. At least six inches of insulation around pipes. Solid monolithic construction eliminates heat losses due to air movement.
2. **Costs less to install.** No concrete box or armored casing required under ordinary conditions. Provision for drainage is usually unnecessary. No metal supports or prefabricated units that require careful handling.
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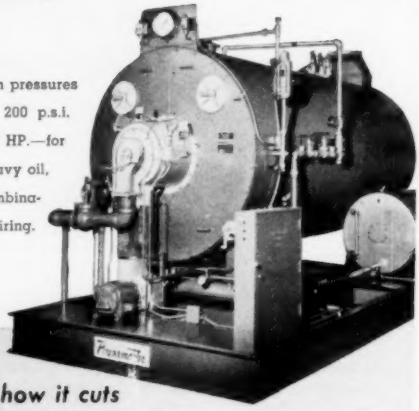

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Additional information may be obtained from the REMA public relations department, 1346 Connecticut Ave., N.W., Washington 6, D. C.

Refrigeration Service Engineers Society, 433 N. Waller Ave., Chicago—The 13th annual meeting, November 17 through 19, Long Beach, Calif.

19th National Exposition of Power and Mechanical Engineering, November 27 to December 2, Grand Central Palace, New York City—The show will be held in conjunction with the annual meeting of the American Society of Mechanical Engineers and, for the first time, will be under the auspices of the society. Show management is being handled by International Exposition Co., Grand Central Palace, New York.

A large number of exhibits will deal with fuels, fuel handling and combustion and a number will reveal improvements for the suppression of fumes and dust. Many other exhibits will also feature equipment for the control of smoke and fly ash.

American Society of Refrigerating Engineers, 40 W. 40th St., New York 18—The 45th annual meeting will be held December 3 to 6, New York City.

National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland 14—The 37th annual convention, December 5 and 6, Hotel Statler, St. Louis.

Plant Maintenance Show and Conference, to be held January 15 to 18 in the Cleveland Auditorium. Advance registration cards and hotel information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, show manager.

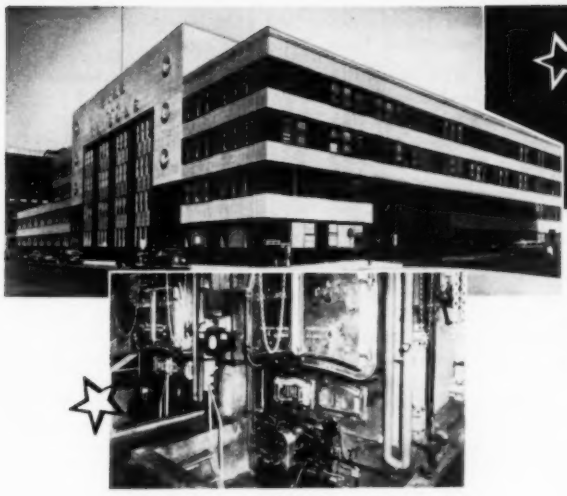
American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York 10—The 1951 annual meeting will be held in Philadelphia, January 22 to 25. Registration and technical sessions will be at the Bellevue-Stratford hotel, other meeting functions at the Benjamin Franklin and Warwick hotels.

10th International Heating, Ventilating and Air Conditioning Exposition—Under the auspices of the American Society of Heating and Ventilating Engineers, the show will be held January 22 to 26, Commercial Museum, Philadelphia. International Exposition Co., 480 Lexington Ave., New York City is managing the affair.

National Association of Corrosion Engineers, 919 Milam Bldg., Houston, Tex.—The 1951 conference and exhibition will be held at the Hotel Statler, New York City, March 13 to 16, and plans are now underway for the presentation of 39 technical papers.

American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5—The 55th annual convention will be held in Buffalo, N. Y., April 23 to 26.

National District Heating Association, 827 N. Euclid Ave., Pittsburgh 6—The 42nd annual meeting will be held June 5 to 8 at the Statler hotel, Detroit.



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American Society for Testing Materials, 1916 Race St., Philadelphia 3—The 1951 annual meeting is scheduled for June 18 to 21, Atlantic City, and the 1952 annual meeting will be held June 22 to 27, New York City.

International Discussion of Heat Transfer—Postwar heat transfer developments will be the theme of a meeting, September 11 to 13, 1951, in London, England. Plans for participation by engineers in the western hemisphere are being arranged by a joint committee on North American participation, which consists of representatives from some 12 professional and engineering societies. The American Society of Mechanical Engineers is coordinatin administrative details. Participation by British and European engineers is being coordinated by the Institution of Mechanical Engineers.

British Building Research Congress—Sponsored by a number of professional institutions and societies, government departments, and representative industrial federations, the congress will be held in London, September 11 to 20, 1951. Additional information may be obtained from the organizing secretary, Building Research Congress 1951, Building Research Station, Bucknalls Lane, Garston, Watford, Herts, England.

The 7th All-Industry Refrigeration and Air Conditioning Exposition, to be held at Navy Pier, Chicago, November 5 to 8, 1951. In all probability, booths will be available in 10, 12, 16, and 20 ft depths. Exhibition space is scheduled to go on sale in November of this year.

New Standards Include 1550 Definitions, Tests, Specifications

With over 8000 pages, including the more than 1550 standards, specifications, tests and definitions for materials, the 1949 Book of ASTM Standards is in six parts.

This important book is made up as follows: Part 1—ferrous metals; Part 2—nonferrous metals; Part 3—cement, concrete, ceramics, thermal insulation, road and waterproofing materials, and soils; Part 4—paint, Naval stores, wood, adhesives, shipping containers, and paper; Part 5—textiles, soap, fuels, petroleum, aromatic hydrocarbons, and water; Part 6—electrical insulation, plastics, and rubber. Each part of the book is complete with a detailed subject index and two tables of contents. To keep it up to date, a supplement will be issued to each part late this year and a complete index to standards is furnished without additional charge.

Part 1 dealing with ferrous metals is the most widely distributed portion of the standards. It contains 1400 pages and about 275 specifications and tests of which some 180 relate to steel and steel products. Specifications cover steel for boiler and pressure vessels, hot and cold finished bars, welding rods, bolting, rivets, pipe fittings, piping, and tubing. Part 2 contains 1166 pages and almost 240 specifications and tests for virtually all of the nonferrous metals and alloys.

Copies may be obtained from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, as follows: Parts 1, 5, and 6, $10.00 each; Parts 2, 3, and 4, $8.00 each; a complete set of all six parts, $54.00. The books are regularly furnished with blue cloth binding and red back straps. For half leather, add $2.00 each.

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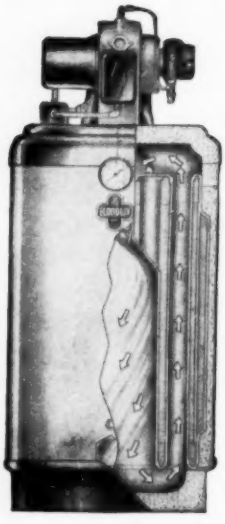

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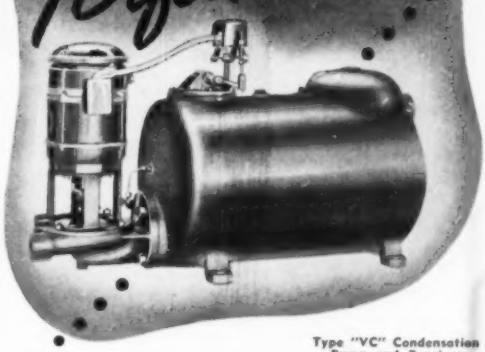

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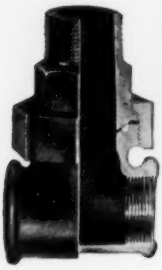

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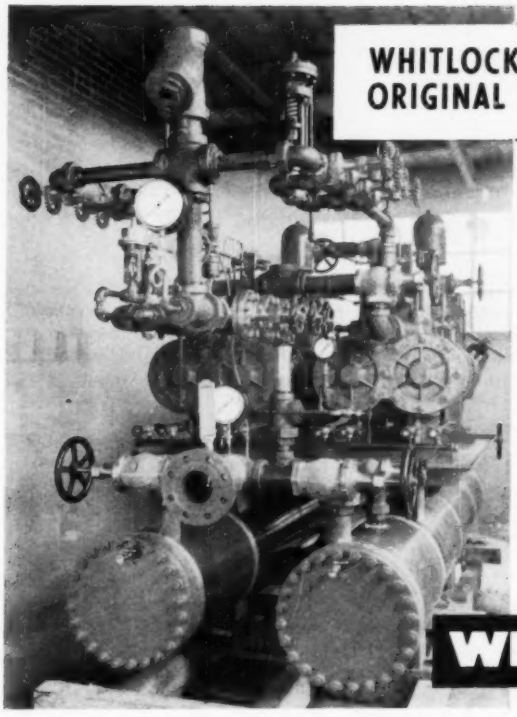
HPAC 101—AIR TRAPS—Armstrong Machine Works, Three Rivers, Mich., has released a new four page bulletin (No. 202) describing its complete line of air traps for automatic drainage of moisture from compressed air intercoolers, aftercoolers, receivers, separators, and drip points. Selection and installation data are included, along with specifications and list prices.

HPAC 102—ALUMINUM ALLOYS—Reynolds Metals Co., 2500 S. Third St., Louisville 1, Ky., has published a 96 page booklet on aluminum alloys. Entitled The A B C's of Aluminum, the booklet deals with the production and fabrication of aluminum alloys, advantages, and applications. A special feature is the series of 69 pictures and charts, arranged in sequence to present a pictorial story showing how aluminum is produced and processed. Pictures of typical fabricating operations, such as welding and forming, are included. Requests for copies should be sent to the manufacturer on your company letterhead.

HPAC 103—CENTRIFUGAL PUMPS—A new bulletin W-306-B1 describing "Monobloc" centrifugal pumps, types DN, DNE, DDNE and DNH, single and two stage, sizes 1 to 5, is available from Worthington Pump and Machinery Corp., Harrison, N. J. The pumps are designed for uses such as small boiler feed, cooling service, condensate service, and circulating brine, volatile liquids, water, etc. The bulletin includes specifications, motor data and materials of construction. Eleven pages are devoted to the selection of cold water pumps.

HPAC 104—COAL STOKERS—Will-Burt Co., Orrville, Ohio has issued a reference manual on its line of underfeed screw conveyor type stokers with multiple tuyere burners and continuous feed gear driven transmissions. Capacities of these stokers range from 20 to 600 lb per hr of coal. Leading off with suggested specifications for stokers, the manual contains tabulated data on coal feeds, ratings, minimum recommended combustion volumes and setting heights, motor sizes, hopper capacities, fan capacities, etc. Other tables give stoker ratings based on the Btu content of the coal used and based on 65 percent conversion efficiency. Also given are details on installation recommendations and dimensional drawings and specifications for the various stokers.

HPAC 105—CONDENSATE RETURN UNITS—The single and duplex condensate return units of Faber Engineering Co., Inc., Amber and Westmoreland Sts., Philadelphia 34, are described and illustrated in Bulletin C50-1. Dimensions and other pertinent data are tabulated for these units which are designed for capacities from 1000 to 100,000 sq ft EDR and for pressures from 15 to 60 psi.



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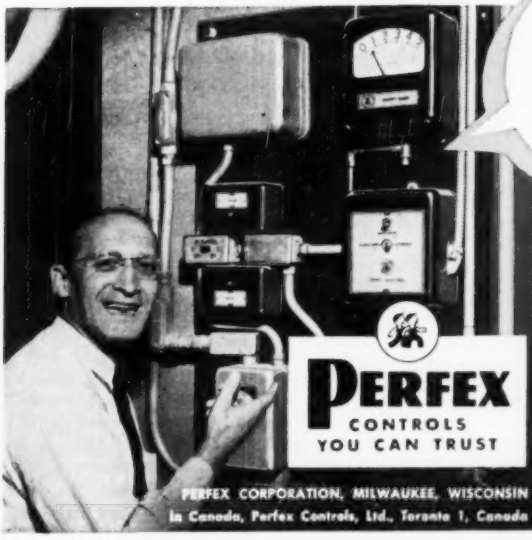

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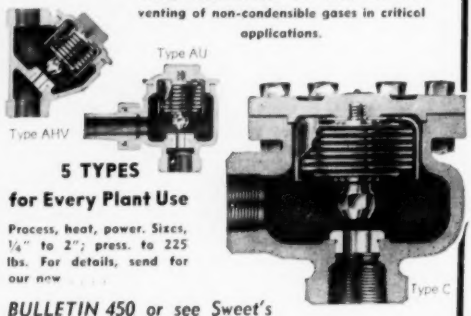

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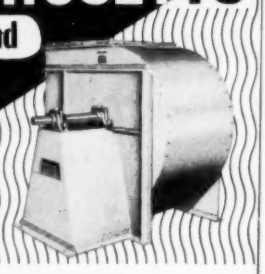

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HPAC 106—CORROSION RESISTANT PAINT—Bulletin 712 of U. S. Stoneware Co., P.O. Box 350, Akron 5, Ohio, covers series K paint, developed primarily to provide protection against fume corrosion or relatively mild corrosive conditions, and series TP paint, designed to provide maximum protection under severe corrosive conditions, particularly when the protected surface is in continuous contact with the corrosive elements. The 12 page bulletin features tabulated data showing resistance characteristics of these paints with respect to numerous chemicals.

HPAC 107—CURTAIN WALL CONSTRUCTION—An interim progress report on proposed methods of curtain wall construction, in which prefabricated sections of stainless steel sheathing backed by insulating materials are used, is now available from Allegheny Ludlum Steel Corp., 2020 Oliver Bldg., Pittsburgh, Pa. Scale drawings are employed to illustrate existing and planned types of these curtain walls with specific attention given to such details as facings, insulation, joints, vents, window sections, etc. The report concludes with a discussion of building codes and tests affecting curtain walls and what is being done to meet them.

HPAC 108—DEEP WELL TURBINE PUMPS—Identified as Bulletin No. 4700, a new 20 page booklet showing construction details, various types of drives and typical installations of deep well turbine pumps has been released by Deming Co., Salem, Ohio. Although widely used for pumping water supply from deep wells for all types of industries, institutions, etc., these pumps are said to have additional applications which include irrigation systems, air conditioning systems (where well water is used as a cooling agent), mine dewatering, and sump pump service. Other services, says the company, include fuel oil and gasoline pumping systems in airports and loading tank cars. Capacities vary from 12 to 3000 gpm.

HPAC 109—DIRECT FIRED HEATERS—Design and construction features of the direct fired heaters (capacities from 300,000 to 7,500,000 Btu per hr) of Arthur A. Olson & Co., Canfield, Ohio, are covered in a new eight page catalog. Dimensions and other pertinent data are tabulated for these units which are designed for gas, oil, coal, or dual gas and oil firing.

HPAC 110—FABRICATING, FINISHING SHEET METAL—Approved methods for fabricating and finishing "Paintgrip" electrolytically zinc coated and bonderized sheet steel are contained in a 12 page booklet published by Armco Steel Corp., 1050 Curtis St., Middletown, Ohio. Recommendations are given on storing, forming, drawing, welding, cleaning, and painting. Satisfactory drawing lubricants, cleaners and paints are also listed

HPAC 111—FLEXIBLE COMPRESSION FITTINGS—Dresser Mfg. Div., Dresser Industries, Inc., Bradford, Pa., has prepared a new 12 page bulletin on its line of flexible compression fittings for pipe sizes up to 2 in. These fittings are factory assembled and are slipped over the plain pipe ends and the nuts are tightened. The furnished gaskets are said to make a permanent, flexible tight seal, permitting 1/16 in. pipe movement as well as

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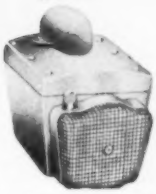

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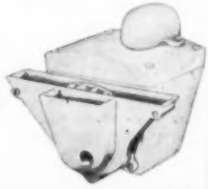

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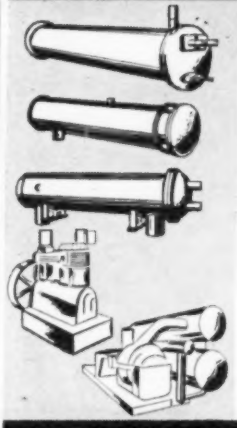

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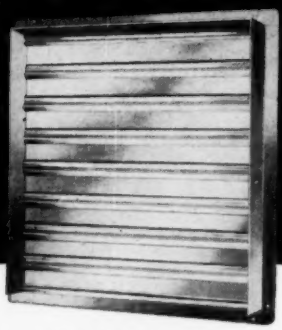

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THE AUTOMATIC SHUTTER WITH ALL THE FEATURES

FRONT VIEW—CLOSED

IT TAKES THE LOAD OFF THE FAN!

Aluminum louvers open fully, permitting capacity fan operation. New heavy reinforcement strip adds strength and long life to the louvers, assures quiet operation and perfect counterbalance, prevents rattling. Deep shroud protects shutter from high winds. Tie-rod, brackets and bearings inside frame, not exposed to weather. Special finish resists corrosion. Many other features.

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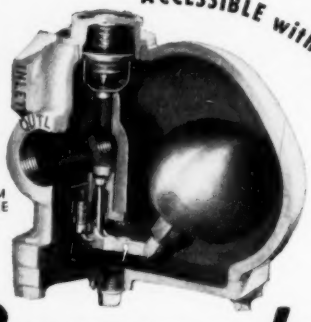
Illustrations and details of the complete Air-Flo line.

AIR CONDITIONING PRODUCTS CO.
2340 W. LAFAYETTE BLVD. • DETROIT 16, MICH.

ACCESSIBLE without disconnecting



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FLOAT & THERMOSTATIC TRAPS

Working parts are readily accessible without the use of special wrenches or disconnecting the trap from the pipe lines. Made in five sizes for handling large and sudden loads of condensate. Low, Medium and High Pressure modifications.

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pipe deflections up to 6 deg. Among the many applications, the manufacturer recommends these fittings particularly to absorb vibration, to simplify cleaning and repair, and to join misaligned pipe. The booklet describes and illustrates features of design and construction and includes tabulated specifications. Applications illustrated include use on compressors and other heavy machinery, on laundry and dry cleaning machines, on factory piping for water, air and fuel lines, on manifold piping for large industrial furnaces, on pumps, boilers and furnaces. Other applications are said to include refrigeration equipment, air conditioning systems, hydraulic machines, chemical feeders, separators, radiant heating, etc.

HPAC 112—GAS BOILERS—Six cast iron boilers in the 22 series, six in the 33, and nine in the 44 are covered in Catalog No. 570 of National Radiator Co., Johnstown, Pa. The boilers are designed primarily for steam and hot water heating but can also be used on direct and indirect hot water storage systems. Output ratings range from 170 to 2700 sq ft of steam radiation and units are recommended for numerous applications, including commercial and industrial.

HPAC 113—GLASS INSULATION—Pittsburgh Corning Corp., 307 Fourth Ave., Pittsburgh 22, is offering a new 36 page booklet on its "PC Foamglas" insulation for commercial, industrial, and public buildings. Included in the booklet is new information concerning the installation of this material in floors-on-ground, the use of the material as a wall lining, for erecting free-standing interior walls, and for ceiling insulation. Also contained are technical data and information on accessory materials. The new line of trowel finishes which can be applied directly to the insulation is also described.

HPAC 114—HEATING, AIR CONDITIONING TRAINING—A new 110 page catalog issued by the Milwaukee School of Engineering, 1020 N. Broadway, Milwaukee, lists occupational objectives and educational programs and describes laboratory and class room training necessary to achieve various service and technical levels. An occupational certificate of "refrigeration serviceman" can be earned in six months of study, according to the catalog. Six additional months comprise training for a "refrigeration-heating serviceman," and a "technician's certificate" is awarded in refrigeration, heating and air conditioning at the completion of 12 additional months training.

HPAC 115—HEATING, COOLING EQUIPMENT—Auburn Burner Co., Auburn, Ind., has issued three data sheets illustrating and describing suspended type, oil fired unit heaters in ratings from 80,000 to 400,000 Btu per hr output, forced air convectors incorporating a finned heating element and one or two small squirrel caged type blowers, and cooling and heating units which incorporate a heat transfer surface (for either hot or cold water), a centrifugal fan, and removable filters.

HPAC 116—INDUSTRIAL PHOTOELECTRIC EQUIPMENT—De-Tec-Tronic Laboratories, Inc., 1227 N. Clark St., Chicago 10, is offering a new eight page catalog describing the company's complete line of photoelectric equipment which features 33 items and includes

Get Easy Control . . Quick Shut-Off
of Air • Gas • Steam • Liquids • Solids

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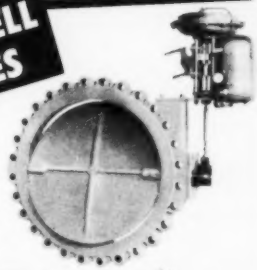

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Automatic Butterfly

Rockwell Valves are rugged, compact; give full flow area, with minimum pressure drop; provide excellent commercial tightness; easy to clean. Made of any suitable metal or rubber-covered for pressures to 60 p.s.i. Equipped with any type manual control or motor, hydraulic, air diaphragm or float type automatic control. Slide Valves available in pipe sizes to 24"; Butterfly Valves in sizes from 1" to 84".

- Low pressure steam for processing equipment.
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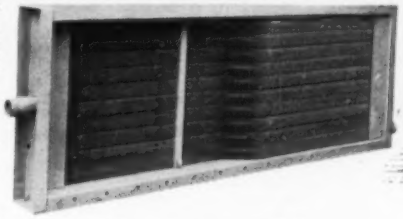
G&O COILS
for ***HEATING and COOLING***



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to meet all industrial requirements.

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have the confidence of the Oil Burner Trade. Experience is the secret. ✩Try them on your next job and note the difference. They promote satisfaction. ✩Write for new catalog

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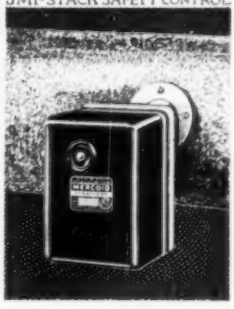

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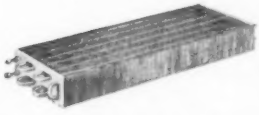
Pipe Coils
Fin Coils
***For* Refrigeration, Air Conditioning, Heating**



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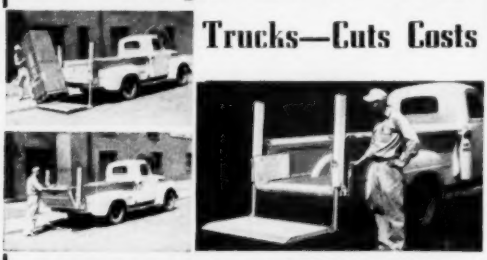

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Now for ½ & ¾ Ton Pick-up Trucks

- ONE MAN OPERATION
- LIFTS OR LOWERS UP TO 800 LBS.
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- PREVENTS DAMAGE TO VALUABLE CARGO
- DRAMATIZES DELIVERIES — BUILDS BUSINESS
- SIMPLE—FAST—EFFICIENT

Twin hydraulic cylinders attach directly to gate—no cables, chains or cranks. Operated by hydraulic pump driven by fan belt. Equipped with throwout clutch, pump runs only when needed. By-pass valve prevents "overloading." Single lever control raises, lowers, or holds gate at any elevation. Gate stops automatically at ground and floor levels. Self contained lift mechanism does not interfere with canopy top, sign panels, spare tire or bumper.

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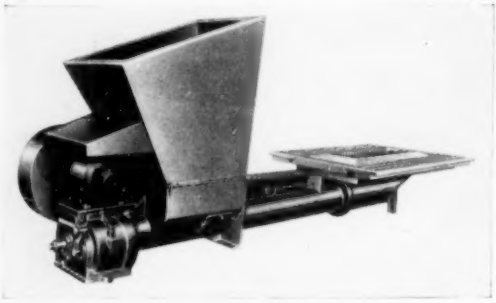
DEPT. 308 STREATOR, ILL.



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This is the Brownell Type "C" wormfeed stoker. Every detail of its construction reveals the knowledge and integrity for which the Brownell name is famous.

The transmission is a husky, precision-built mechanism with 3-speed anti-clash gearshift, automatic safety stop switch, and thorough lubrication. The hopper is heavy, corrosion-resisting sheet metal on a steel plate base. The feed worm is cast alloy steel. The furnace ironwork consists of heavy, air-cooled sectional tuyeres and dead-plates or side-dump grates.

A gas-repellant valve prevents blow-back of smoke and fumes. Automatic air volume control is optional at extra price. Eleven sizes are available with ratings of 45 to 258 boiler h.p. *Ask for fully descriptive bulletin and data.*

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accessories for such industrial applications as production control, counting, boiler and ventilating smoke detectors, and warning devices.

HPAC 117—MAGNESIA INSULATION—Mundet Cork Corp., Insulation Division, 7101 Tonnelle Ave., North Bergen, N. J., has issued a new four page booklet on its new 85 percent magnesia pipe covering and block insulation. Briefly covered are manufacturing facilities and advantages of this insulation which is designed for temperatures up to 550 F. Also mentioned is an insulation for higher temperatures, and a feature of the catalog is a table of simplified thickness standards.

HPAC 118—MOTOR DRIVEN WELDERS—The "Shield-Arc" SAE welders of Lincoln Electric Co., Cleveland 1, Ohio, are available as a-c motor driven models (200, 300, 400, 600 and 900 amp) and as d-c models (200, 300, and 400 amp). They are described and illustrated in a new four page bulletin.

HPAC 119—OVER-FIRE AIR SYSTEM—Canton Stoker Co., Canton 1, Ohio, has prepared an eight page illustrated folder on its new "Turbo-Air" over-fire air system designed to maintain the maximum combustion of coal fuels, and to eliminate smoke nuisance. Copies of the folder may be obtained by writing to the manufacturer on your company letterhead.

HPAC 120—PROTECTIVE COATINGS—The metal protective and paint bonding chemicals and processes of American Chemical Paint Co., Ambler, Pa., are designed to either protect metals directly or create a base and bond for decorative finishes so that these, in turn, can provide both protection and appearance. A new eight page bulletin contains an index which lists most of the chemicals as to type and their application to the commonly used industrial metals. Also included is a discussion covering their purpose, characteristics, advantages, and effectiveness.

HPAC 121—REFRIGERATION CONDENSERS, HEAT EXCHANGERS—Bell & Gossett Co., Morton Grove, Ill., has issued two new handy, quick selection sheets on its refrigeration condensers and refrigeration heat exchangers. Bulletin No. CR-1049 covers model CRF shell and finned tube condensers and Bulletin No. CU-1149 covers model RH refrigeration heat exchangers. Technical data for selecting equipment are tabulated.

HPAC 122—REFRIGERATION OILS—Technical Bulletin B-3 (Revised) of Sun Oil Co., Philadelphia 3, deals with lubrication of refrigeration and air conditioning equipment. Subjects covered include types of refrigerating systems, functions of essential parts, characteristics of refrigerants, the effects of refrigerants on oils, lubrication recommendations, and applications of refrigeration. Also described are "Suniso" oils for air conditioning, commercial refrigeration, and low temperature installations.

HPAC 123—RUST PREVENTION—Its story of industrial rust prevention is told in a new catalog released by Rust-Oleum Corp., 2425 W. Oakton St., Evanston, Ill. Information is given on uses and general exposure and

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BROWN BAYCE-HEET

Protrudes only 1⅛" from Wall

- Smart looking, protrudes only 1⅛"
- 615 B.T.U. per lineal foot with 170° water temperature
- Fins have amazing heat area due to exclusive beading process which provides greater radiation surface and durability
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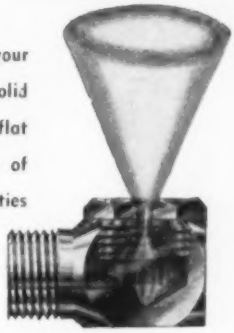
Specify Delavan for your spray nozzle needs. Solid cone, hollow cone and flat sprays. Complete range of spray angles and capacities for various pressures.



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Leaks on lines carrying oil (hot or cold), gasoline, kerosene and high pressure steam are a costly waste. Key Graphite Paste provides a perfect seal for these lines. It expands under heat but will not freeze the connection. Joints completely sealed with Key Graphite Paste can be easily disconnected without damage to threads or gaskets. Eliminate expensive leakage with Key Graphite Paste. Listed by Underwriters Laboratories.

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Ageless Beauty—Lifetime Utility

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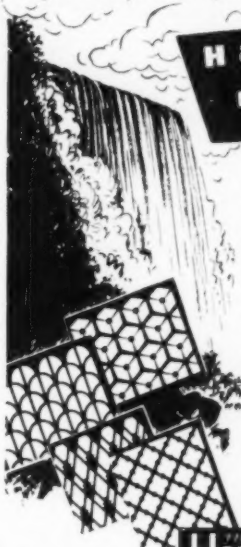

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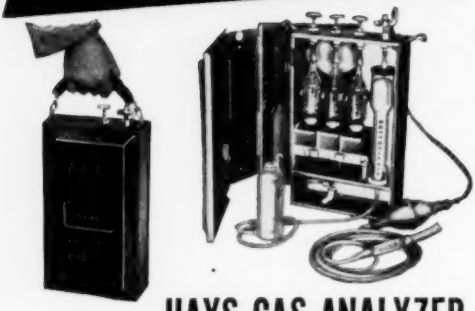

HAYS GAS ANALYZER

The Hays gas analyzer (or Orsat) tells if oil burner or stoker is properly installed—or if combustion is at maximum efficiency. Gives *accurate* readings of draft, CO_2 and flue gas temperature. Available in several styles from the single to the multiple chamber model shown which analyzes CO_2, O_2 and CO. All sizes available from stock. Write for helpful literature . . . FREE!

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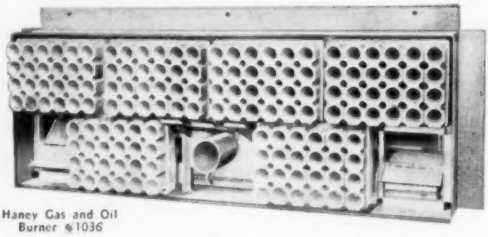
1000 SERIES HORIZONTAL BURNERS



Haney Gas and Oil Burner #1036

The HANEY 1000 SERIES BURNERS arranged in many shapes and sizes are complete with windbox, full size gas manifold, automatic vane type air louvre and linkage, tailor-made for your installation giving long life, free from trouble.

Full modulation and operation at pounds or inches of pressure make them suitable for all types of horizontal firing.

We'll be glad to send more information on request . . . . please write!

HANEY GAS BURNER AND ENGINEERS

909 South Myrtle Street, Monrovia, California

other special conditions which produce rust on machinery and implement finishes, heat resistant and chemical resistant coatings, floor coatings, etc. Also covered are some three dozen different kinds of applications. The company's sealers for materials other than iron and steel are also featured and color chips are used to show some 70 colors. Specifications indicate resistant qualities, drying time, thinner requirements and methods of application.

HPAC 124—SMALL WATER SOFTENER—A small zeolite water softener for apartment houses, hospitals, laundries, small boiler and industrial plants (where the requirements may be under 100 gpm) has been developed by Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia 32. Designed for low initial cost, simplicity of operation and for low cost of chemicals used, the "Junior" industrial softener is supplied in two groups and in single and in double units. Detailed information is given in Publication 4505.

HPAC 125—SPEED REDUCERS—Falk Corp., Milwaukee 8, has issued two new bulletins illustrating and describing its new concentric shaft speed reducer and its new right angle shaft, all-steel speed reducer. These speed reducers are designed for a wide variety of power transmission requirements in almost every industry and are adaptable to electric motor drives, belt drives, gas engine drives, chain drives, etc. They are suitable for use as speed increasers or reducers and the approximate horsepower range of both units is 1 to 50.

HPAC 126—STAINLESS STEEL VALVES, FITTINGS Cooper Alloy Foundry Co., Hillside, N. J., has published a new 48 page catalog (No. 52) containing engineering drawings, weights, dimensions, size ranges, materials, corrosion data, nomenclature and design information on its stainless steel valves and fittings. Stainless steel, nickel and monel gate, globe, angle, needle, Y, check, tank and other valves are covered, together with screwed, flanged, welded and forged fittings, gages, pet and plug cocks, hose fittings and other accessories.

HPAC 127—STEEL BOILERS—A 48 page consolidated catalog (No. AP237-B) now available from Pacific Steel Boiler Div., United States Radiator Corp., Detroit 31, Mich., is said to be all-inclusive, to cover the entire line, and to contain all necessary data for specifying steel boilers. Commercial boilers covered include low water line boilers, high fire box boilers, "Dry-Back" Scotch marine boilers, front smoke outlet boilers, G series boilers, split firebox boilers, and minimum dimension boilers. Also covered are hot water supply and storage tanks for commerical boilers and "Pacific-Wing" induced draft fans for low water line and high firebox boilers and for the Scotch marine boilers.

HPAC 128—STRAINERS AND SEPARATORS—Bulletin No. R-46-50A of American District Steam Co., North Tonawanda, N. Y., is a completely revised 16 page catalog of Y and T type strainers, suction strainers, multi-flow separators and receiver-separators. It contains descriptions, dimensions, weights and list prices of the entire line. Several types have been completely redesigned for increased efficiency and the range of sizes has been increased.

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Opportunities are being offered to Engineers and Draftsmen who can design and/or prepare engineering drawings for industrial buildings and their facilities. Assignments are not for specific projects but are in our regular engineering staffs in long-established offices, located on the East Coast, Central West, Gulf Coast, and West Coast. Good working conditions. Established vacation and sick leave plans, also paid holidays.

Positions are open to men possessing a sound background of education and experience qualifying in—

Industrial Plant Equipment • Process Piping • Power Plants • Heating Systems • Air Conditioning and Ventilation • Conveying Systems • Plumbing and Sewers • Sprinkler Systems.

Full particulars as to education, experience, and compensation desired should be given in first letter.

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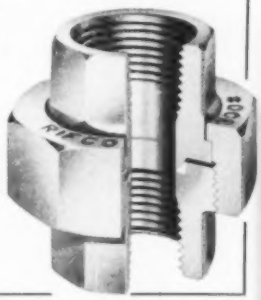
it's the RIFCO 300

The Rifco 300 union is a rugged quality product especially suitable where high pressures or temperatures are encountered. Heavily constructed throughout, with thick pipe ends and nut it will absolutely meet 300 lbs. pressure for steam or 400 lbs. for oil, water or gas.

The bronze seat is an integral part of the unit, but the 300 is also available in All Iron Seat.

The Rifco 300 will put an end to fitting worries. Please write us today for more information.



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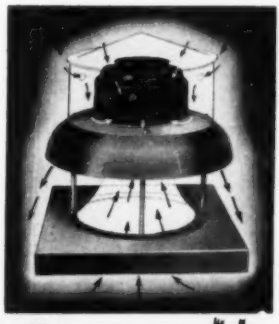
Motor is OUT of airstream.

Positive air expulsion using squirrel-cage fan.

Negative air flow through motor hood prevents formation of explosive or corrosive fumes.

Heaviest construction of any similar device. SPECIAL metals for unusual conditions.



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Streamlined inlet design ELIMINATES turbulence—aids quiet operation.

RATING CERTIFIED by independent testing agency under direction of a nationally recognized authority.

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DRIVE-IT 300

Over 9000 drive-pins were used at the Eastgate Apartments to fasten ceiling runner channels to concrete "at a saving of over 50%" writes the contractor.

Drive-It is one of the greatest cost-cutting tools ever invented. Hundreds of letters attest to the fact that steel or wood to concrete or steel fastening can be done with Drive-It *at savings of 50% to 85% in man-hour costs!*

Every architect, building engineer and contractor should investigate the DRIVE-IT system of fastening. It is Underwriter Laboratories approved for efficiency and holding power and engineered for *taper-safe* operation.

ONLY DRIVE-IT "300" GIVES YOU ALL THESE FEATURES

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INSULATE
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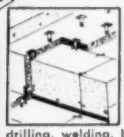

Miracle Surface Anchors banded with Miracle Adhesives provide firm anchorage for all types of Insulation. This includes Batt, Fiber Glass, Foam Glass, Cork, etc. to ducts, walls, or ceilings. No drilling, welding, bolts, screws or other mechanical means of attachment required. Miracle Surface Anchors are available in a variety of shapes and sizes to accommodate the particular job, and have been endorsed by leading Insulation Contractors and Architects everywhere because of their labor and time saving features. For information write:

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FREE: Interesting, colorful brochure on "miracle surface anchors"! Write for your copy today.

HPAC 129—STUD WELDING—A 16 page illustrated booklet, reprinting the chapter on stud welding from the third edition of the Welding Handbook, recently published by the American Welding Society, is available from Nelson Stud Welding Div., Morton Gregory Corp., Lorain, Ohio. The article explains the stud welding method of fastening, describes the equipment and its principal uses, and gives stud locating procedures.

HPAC 130—TANK GAGES—The new liquid depth indicator of Petrometer Corp., One Star Square, Long Island City 1, N. Y., is an instrument designed to indicate the depth of any liquid stored in any type of tank, well, or reservoir. This nonmechanical instrument features an installation which consists of only one ¼ in. copper tube line with one compression connection at the gage. Bulletin 2004 gives detailed information.

HPAC 131—TEMPERATURE AND PRESSURE INSTRUMENTS—Catalog 86 of Fischer & Porter Co., Hatboro, Pa., illustrates and describes temperature instruments having thermal systems filled with liquid, vapor-liquid, or gas and covering ranges between —125 F and 1000 F, together with pressure instruments having bellows, multiple-diaphragm, slack-diaphragm, or helical pressure-measuring elements covering ranges between 30 in. Hg vacuum and 10,000 psi.

HPAC 132—THERMOSTATS—The "Thermoswitch" is a thermostat designed for temperature control and detection by Fenwal Inc., Ashland, Mass. The manufacturer has recently issued a new price list which is said to reflect increased labor and material costs.

HPAC 133—UNIONS AND VALVES—Its complete line of hot forged steel unions and valves is covered in Catalog 11 of Catawissa Valve and Fittings Co., Catawissa, Pa. Specifications and prices are given on standard weight unions, orifice unions, lug nut unions, double extra heavy unions, stainless steel unions, alloy steel unions, swing check valves, spring controlled check valves, and double extra heavy swing check valves.

HPAC 134—VENT VALVES—The vapor equalizing valves and air eliminators of Gorton Heating Corp., Cranford, N. J., are said to be unusually quick venting valves for steam heating systems. The vapor equalizing valves for radiators are made with five sizes of air outlets. The air eliminators for mains and unit heaters are offered with a ⅜ in. vertical connection or with a ½ in. vertical connection. Bulletin No. 118 and price sheet No. 50 give detailed information.

HPAC 135—WATER EVAPORATORS—"Paracoil" evaporators and particularly their conversion to modern low pressure vacuum type distillation plants is described in a new illustrated bulletin (No. 40A) issued by Davis Engineering Corp., 1064 E. Grand St., Elizabeth, N. J. The bulletin includes photographs, cycle diagrams of single and double effect plants and performance data.

HPAC 136—WATER TREATMENT—Prevention of lime scale deposition by "threshold treatment" of water is described in a new folder offered by Calgon, Inc.,

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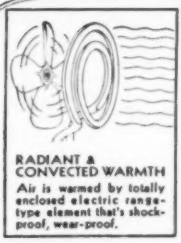

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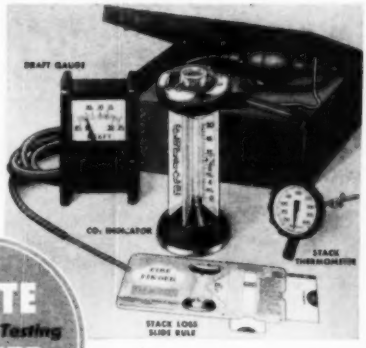

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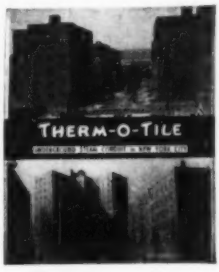

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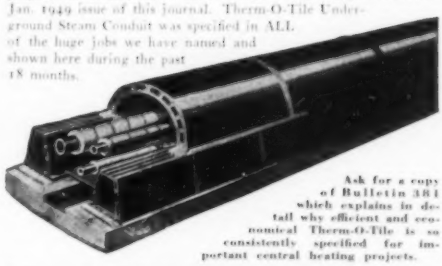

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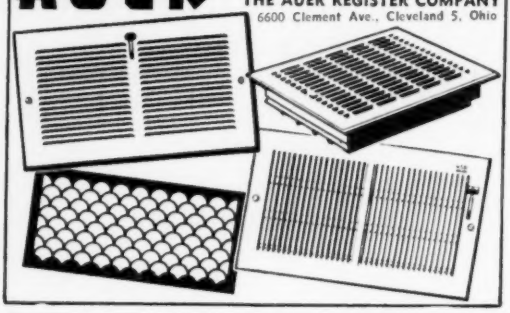

"... did YOU make a note about the message on page 221?"

Hagan Bldg., Pittsburgh 30. The material used, a vitreous sodium phosphate, is dissolved and the solution is added continuously to the water, effective concentrations ranging from about 1 to 10 parts of the material per million of water.

HPAC 137—WELDED STEEL TUBING—Structural advantages, methods of fabricating and characteristics of welded steel tubing are discussed in a new 12 page illustrated booklet published by Armco Steel Corp., Middletown, Ohio. The booklet gives information on finishes, tolerances, mechanical properties, and describes a variety of uses where tubing may be used effectively.

HPAC 138—WELDING RODS AND FLUXES—Condensed information on its line of low temperature welding and brazing rods and fluxes is contained in a new data sheet and a small booklet prepared by All-State Welding Alloys Co., Inc., White Plains, N. Y. Uses, methods of application, and weld characteristics are covered.

HPAC 139—WORM GEAR SPEED REDUCERS—IMO single reduction, horizontal and vertical worm gear speed reducers are described and illustrated in Bulletin G-WBV of De Laval Steam Turbine Co., Trenton 2, N. J. The catalog describes how units are manufactured, lists types of speed reducers, and includes selection tables, horsepower ratings, overhung load ratings, and dimension tables. A special section describes vertical speed reducers for cooling tower service.

Offers Coefficients for Determining Heat Transfer of Straight Fins

Local Coefficients of Straight Fins, by M. L. Ghai and Max Jakob, of Illinois Institute of Technology, is the report of an investigation carried out to determine the variation of local coefficients of heat transfer, hitherto unknown, between the root and tip of straight fins, using air as the cooling fluid. It was found that the coefficient at the root is much smaller than at the tip.

Coefficients were determined primarily by a theoretical equation of finite temperature differences in a fin and the measurement of many local surface temperatures. Such problems were faced as, how to install 50 thermocouples in a fin element 2 in. by 4 in., how to run each thermocouple for 2 to 3 in. in an approximately isothermal zone and how to guide all thermocouple wires so that the air flow over the fins is not disturbed. To overcome these difficulties, the construction of experimental fins of an unusual design was necessary. Fin spacing was varied from $\frac{1}{8}$ in. to $\frac{3}{4}$ in., and air velocity was varied from 21 fps to 77. The results were correlated in terms of local Reynolds and Nusselt numbers.

According to the authors, the local coefficients found in this investigation can be used to determine precisely the heat dissipated by a fin. But, since this requires a very complicated procedure, a simpler approximate method based on a mean coefficient of heat transfer has also been developed.

Presented at the recent spring meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, the paper is identified as No. 50-S-18.

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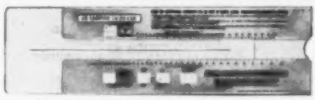

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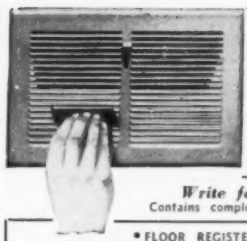

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LONG ESTABLISHED MIDWEST contracting company doing heating, ventilating, and air conditioning, requires man preferably 30 to 45 years old to take charge of sheet metal department. Must be capable of making estimates, sketches, and have ability to measure jobs. Perfect opportunity for right person. Good salary with share in profit. State age, education and experience. Address Key #876-A, Heating, Piping & Air Conditioning, 6 No. Michigan Ave., Chicago 2.

Engineer wanted as manager of our heating department; should have a broad engineering experience in the heating contracting business, capable of handling and supervising the estimating, buying, and installation of large installations. Prefer man between forty and forty-five who is willing to assume responsibility. Address James S. Cassedy, Inc., 133 Austin St., Cambridge, Mass.

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A new line of fans with the same **HEAVY-DUTY** construction found in all Clarage equipment! . . . and with **money-saving advantages,** compared to older, less modern designs.

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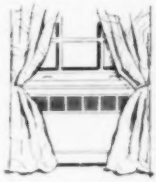

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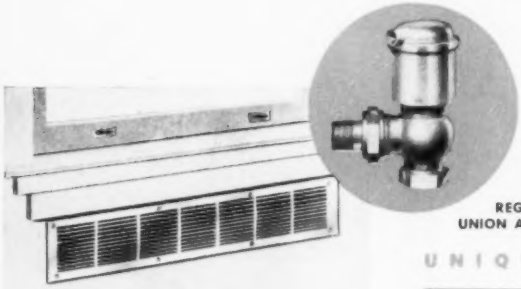

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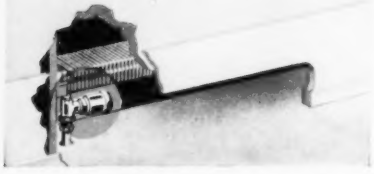

UNIQUE VALVE STEM PACKING

FOR STEAM

Moulded split-ring packings, especially compounded for low pressure steam, insure long life with minimum attention. Easily accessible for adjustment or repacking.

FOR WATER

Unique V-ring, self-sealing packing utilizes the force of the water pressure to effect a positive seal. (Automatically compensates for changes in water pressure.) No initial manual adjustment is required. No need for servicing. Prevents leakage, regardless of the elevation at which the valves are installed.

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For information on any automatic temperature control problem—large or small—ask a nearby Johnson engineer. His advice and counsel are yours without obligation. This is a Johnson courtesy. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

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